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THE BEAST WITH MANY HEADS: SITUATIONAL AND DISPOSITIONAL DIFFERENCES IN PHYSIOLOGICAL, SUBJECTIVE, AND BEHAVIORAL RESPONSES TO SOCIAL REJECTION

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THE BEAST WITH MANY HEADS: SITUATIONAL AND DISPOSITIONAL DIFFERENCES IN PHYSIOLOGICAL, SUBJECTIVE, AND BEHAVIORAL RESPONSES TO SOCIAL REJECTION

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Threats to humans' deep-rooted social needs are associated with strong physiological, emotional, and behavioral responses that are linked to systems for physical pain responses. Yet, prior research has also revealed inconsistencies in responses to social threats, which may be related to differences in situational or dispositional factors. In exploration of these potential explanations, the proposed research aims to investigate physiological, subjective, and behavioral responses to two distinct types of social threat experiences. This study will involve analyzing data collected from a sample of 127 students at a midwestern state university who participated in a laboratory experiment in which they faced one of two types of social rejection or acceptance experiences: the Cyberball paradigm (Williams, Yeager, Cheung, & Choi, 2012) or the "Future Life" paradigm (Twenge, Baumeister, Tice, & Stucke, 2001). Participants were also provided an opportunity to engage with another (supposed) individual to identify prosocial and antisocial response patterns. Participants' fear of negative social evaluation was assessed as an individual difference factor; current levels of affect, basic needs satisfaction, and cortisol responses were tracked during the procedures. Results indicate interrelated physiological, affective, and subjective responses to social rejection and acceptance, which vary as a function of both situational and dispositional factors, and are consistent

with evolutionary theories of human's social nature. Theoretical, developmental, and practical implications are discussed.

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MULTIMEDIA OBJECTS

The Beast with Many Heads: Situational and Dispositional Differences in Physiological, Subjective, and Behavioral Responses to Social Rejection

For nearly 2500 years, humans' social nature has been expounded by the greatest human minds: from Plato (Burnyeat, 1999) and Aristotle (Kraut, 2007) to Thomas Aquinas (Crofts, 1973) to Kant and Rousseau (Purdy, 2005; Steinkraus, 1974). In the twenty-first century, research from several scientific disciplines – including psychology, neuroscience, anthropology, comparative biology, and linguistics – has converged in support. It is becoming increasingly evident that humans are uniquely attuned to and wired for their social world. In fact, humans' social nature is widely regarded as both a consequence of and impetus for physical and cultural evolution (Dunbar, 2009, 2016; Gowlett, Gamble, & Dunbar, 2012; Henrich & McElreath, 2007; Meloni, 2014; Oesch, 2018; Russel & Muthukrishna, 2021; Shultz & Dunbar, 2012; Sutcliffe, Dunbar, Binder, & Arrow, 2012; Tomasello, 2014).

Among the many implications of social evolution, the centrality of human's social nature is expressed as a fundamental need for belonging (Allen, Gray, Baumeister, & Leary, 2022; Baumeister & Leary, 2017; Leary & Baumeister, 1995) and for social connection (Hodges & Gore, 2019; Holt-Lunstad, 2018; 2021a, 2022a, 2022b; Holt-Lunstad, Robles, & Sbarra, 2017). When fulfilment of these needs is threatened or interfered with, people experience a social pain response that activates many of the same neural systems as the physical pain response (Eisenberger, 2012a, 2012b; Eisenberger & Lieberman, 2004, 2013; McDonald, 2009, McDonald, Kingsbury, & Shaw, 2013). Researchers have also identified that social threats activate physiological stress reactions

(Bass, Stednitz, Simonson, Shen & Gahtan, 2014; Beekman, Stock, & Marcus, 2016; Cacioppo, Cacioppo, Capitanio, & Cole, 2015; Cacioppo & Hawkley, 2003; Dickerson & Zoccola, 2013; Linnen, Ellenbogen, Cardoso, & Joober, 2012).

However, despite clear evidence that social threats generate both pain and stress, evidence of emotional responses has been inconsistent, with reports of either increased emotional distress and or flattening of emotions, depending on the study and scenario (e.g., Bernstein, 2010; Bernstein & Claypool, 2012a, 2012b; DeWall, 2009). Similarly, there is paradoxical evidence of how social threats impact social behavior: there is indication of a drive to seek social reconnection, evidenced through prosocial or social approach behaviors (DeWall & Richman, 2011; Maner, DeWall, Baumeister, & Schaller, 2007; Sunami, Nadzan, & Jaremka, 2019) but other research has found responses that are retaliatory, aggressive, or antisocial (Ren, Wesselmann, & Williams, 2018; Reijntjes et al., 2011; Sunami et al., 2019; Twenge, Baumeister, Tice, & Stucke, 2001).

Although many explanations have been levied to explain why there may be differences in emotional or behavioral responses to social injuries – ranging from individual difference factors to characteristics of the social experience itself – little research has been done to experimentally test these explanations and none (to-date) have done so in a way that would allow for an understanding of how dispositional and situational factors may *interact* to produce distinct response pathways. Despite evidence of impact on multiple systems, there is no truly systemic account of responses to social rejection: the interrelations among physiological, subjective, and behavioral responses remain unclear and under-explored. The current study is specifically designed to address

these knowledge gaps by accounting for differences in both disposition and situation and allowing for simultaneous measurement of physiological, subjective, and behavioral dimensions of the social rejection response.

Humans Are a Distinctively Social Species

Humans' reactions when social needs are threatened or thwarted can only be understood in the context of humans' profoundly social nature. To say that humans are a social species encompasses more than an enjoyment of social interaction or the capacity for it. Examining the role of social behavior in both phylogeny and ontogeny reveals that human's social nature is, in many ways, the very basis of human existence (Dunbar, 2009, 2016; Gowlett et al., 2012; Henrich & McElreath, 2007; O'Brien & Bentley, 2017; Oesch, 2018; Russel & Muthukrishna, 2021; Shultz & Dunbar, 2012) and fundamental to the way people experience life (Creanza, Kolodny, & Feldman, 2017; Meloni, 2014; Mercer, 2013; Sutcliffe et al., 2012; Tomasello, 2014).

The Origins of Humans' Social Nature

Humans are a social species by every definition: among these, the tendency to live in groups and interact frequently, the capacity for complex communication, the formation of social hierarchies and social roles, and an inclination towards prosocial behaviors (Dunbar, 2009, 2011 2016; Henrich & McElreath, 2007; Mercer, 2013; Oesch, 2018). Yet, humans are distinct from other social species (Bertelsen, Høgh-Olesen, & Tønnesvang, 2009; Høgh-Olesen, 2010) in both the complexity of social behavior as well as the manner in which humans' "social nature" has catalyzed physical and cultural

evolution (e.g., Dunbar, 2009, 2011, 2012, 2016; Henrich & McElreath, 2007; Oesch, 2018; Russel & Muthukrishna, 2021).

There is considerable evidence that the evolution of many of humans' advanced cognitive capacities is a consequence of social demands. As articulated by the social brain hypothesis (Dunbar, 2009), humans' propensity for group living – which itself conferred evolutionary advantages such as access to protection, mates, and other resources – necessitated the development of capabilities such as language and social cognition. The evolution of these capabilities, in turn, led to advances in general intelligence, decision-making, reasoning, and other higher-order capabilities (Dunbar, 2009, 2011, 2012, 2016; Meloni, 2014; Mercer, 2013; Oesch, 2018;). The correlation between the social demands of living within large social networks and neocortex evolution among a range of species is often cited in support of this hypothesis (Dunbar, 2009, 2011, 2012, 2016; Oesch, 2018). Living in larger social groups is also associated with specific gains in brain volume in regions associated with the processing of social emotions and theory of mind (Dunbar, 2012, 2016; Meloni, 2014; Mercer, 2013; Oesch, 2016). Computational models have also supported a social explanation for neural evolution, indicating that the increased cognitive processing demands of expanding social network size (e.g., communication, behavioral coordination, cultural transmission) necessitate both general and specific advances in the brain (David-Barret & Dunbar, 2013).

Dual inheritance theory (Henrich & McElreath, 2007; O'Brien & Bently, 2017; Russell & Muthukrishna, 2021) also emphasizes the role of social pressures, social capacities, and the social brain as impetus for human evolution. However, dual

inheritance theory focuses on the interaction between biological factors (i.e., genetics) and cultural evolution – via social transmission – as an explanation for human nature and the complex cumulative culture that sets humans apart from other species: our social nature is both a hard-wired product of evolution and a driving force behind it.

By this account, social abilities did not just make humans smart *individuals*, they made humans smart *collectively*. The difference between being "social" animals and being "cultural" animals is evidenced by the fruits of humans' cumulative culture –from vast bodies of collective knowledge (science, languages, histories) to advanced cultural products (technology, architecture, etc.) – to which no other species compares and which would not be possible without genetic inheritance of cultural traits (Henrich & McElreath, 2007; O'Brien & Bently, 2017; Russell & Muthukrishna, 2021).

That a social nature is closely tied to humans' evolutionary legacy is further underscored by the heritability of social traits and social skills. For example, both aggression (Dochtermann, Schwab, Anderson Berdal, Dalos, & Royaute, 2019; Porsch et al., 2016) and altruism (Dochtermann et al., 2019; Reuter, Frenzel, Walter, Markett, & Montag, 2011) demonstrate moderate to high heritability. Although it may seem inconsistent to suggest that both aggression and altruism – traits that are very different, almost "opposite" in nature – have adaptive value, both behaviors are critical in human's complex social landscape. Group living requires the propensity to defend oneself against personal transgressions and to defend one's group from external threats, including from other groups (Anderson & Bushman, 2002; Wrangman, 2018). At the same time, group living requires a penchant for altruistic behaviors that engender reciprocity and benefit

the wellbeing of the group as a whole (e.g., inclusive fitness theory; Ferriere & Michod, 2011; Kurzban, Burton-Chellew, & West, 2015).

There is also evidence of moderate to high heritability of social competence (Taborsky & Oliveira, 2012) and the more fundamental capabilities that enable it, such as aspects of face perception (e.g., processing facial affect; Anokhin, Golosheykin, & Heath, 2010; Wilmer et al., 2010) and theory of mind (Warrier & Baron-Cohen, 2018). Like aggression and altruism, heritability estimates for these social skills can be as high as 60%, which parallels many heritability estimates of general intelligence and cognitive ability. The degree of heritability of social traits provides clear evidence that human's social nature is core to inclusive fitness processes and a fundamental mechanism of human evolution. Put another way, humans' social nature is in no way a matter of secondary importance or mere byproduct of non-social evolution (Henrich & McElreath, 2007; O'Brien & Bently, 2017; Russell & Muthukrishna, 2021).

In fact, humans have evolved to rely on environmental input for normative development. There are many developmental processes that are either experience-expectant, meaning that they require environmental input for normal development, or experience-dependent, meaning that they have evolved to be highly malleable by environmental input. Importantly, these environmental inputs are very frequently social in nature; it is input from social experiences and interactions with other people that the human organism has evolved to expect or adapt to (Fandakova & Hartley, 2020; Galván, 2010). For example, the neural circuits involved in the production and comprehension of language require input from other humans – exposure to language – early in the lifespan

to develop typically (i.e., an experience-expectant process; Oyama, 1976, 1978). Learning experiences, including those that occur in the family environment, educational settings, or from exposure to cultural norms and expectations are experience-dependent processes which shape the developing brain – *physically* as well as functionally (Als et al., 2004; Dawson, Ashman, & Carver, 2000; Fandakova & Hartley, 2020; Fox, Levitt, & Nelson, 2010; Galván, 2010; Tierney & Nelson, 2009).

The human brain itself has evolved mechanisms that are purposely sensitive to experiences, including social experiences, and thus allow individuals to adapt to their specific and ever-changing environment. Social experiences – especially if repeated – can cause structural changes in the brain or changes in the functioning of the brain by altering neurons (brain cells), synapses (connections among brain cells), or neurotransmitters (chemical messengers in the brain) through processes like learning (i.e., long-term potentiation), synaptic pruning (selective elimination of connections among brain cells), neurogenesis (creation of new brain cells), and other processes of neural plasticity (Bourgeois, 2005; Fandakova & Hartley, 2020; Galván, 2010; Johnston, 2009; Rapoport et al., 2001).

Robust evidence of gene x environment correlations (e.g., Brendgen, Zheng, Vitaro, Dionne, & Boivin, 2023; Perlstein & Waller, 2022; Zheng, Fletcher, Zheng, & Lu, 2022), and epigenetic modification (e.g., Brendgen, 2012; Palumbo, Mariotti, Iofrida, & Pellegrini, 2018; Vaiserman, 2015; Waltes, Chiocchetti, & Freitag, 2016) provide multiple pathways through which humans adapt – at a genetic level – to their social context. The existence of these processes is a clear reflection of the necessity for humans

to be malleable to the social environment in order to maintain inclusive fitness, once again reinforcing the centrality of the social environment as a catalyst for human development and evolution. Within a lifespan perspective, these mechanisms help to explain how and why social interactions with family members (e.g., Hayden et al., 2013; Kryski et al., 2014; Sheikh et al., 2014) and peers (e.g., Brendgen, 2012; Brendgen et al., 2023; Zheng et al., 2022) can alter the expression of underlying genetic traits involved in temperament, mental health, and social behavior.

Importantly, family and peers provide two of the most critical social systems from an evolutionary perspective: families, particularly parents, typically provide the first and primary source of nurturance, protection, and learning that is critical to individuals' survival and success (Badyaey & Uller, 2009; Gross, 2005), while peer groups provide access to friends, allies, mates, and other adaptive social connections, and are a key social context for social status dynamics that influence continued access to social and nonsocial resources (Hawley & Bower, 2018; Maner & Menzel, 2012). Human culture has evolved such that humans must navigate these social networks to survive and reproduce (Creanza et al., 2017; Henrich & McElreath, 2007; O'Brien & Bently, 2017), creating a clear evolutionary advantage for a high degree of susceptibility to families and peers as key determinants in the social environment.

For example, exposure to early life stress such as neglect, violence, or maltreatment in the family environment has been linked to epigenetic modification of the human genome and other changes in gene expression (gene x environment interaction) which result in the development of protective behaviors, such as social avoidance or

aggression (Brendgen, 2012; Palumbo et al., 2018; Vaiserman, 2015; Waltes, Chiocchetti, & Freitag, 2016). Thus, social susceptibility can help individuals embedded in "dangerous" environments to better insulate themselves or defend themselves from future threats. There is some evidence that similar experiences in the peer context, such as severe or chronic peer victimization or social rejection, can invoke a similar pattern of protection at the biological level (Brendgen, 2012; Brendgen et al., 2023).

Also consistent with an evolutionary account of sensitivity to the social environment, there is population-level variability in the degree to which individuals are affected by the social context. A number of theories conceptualize the manner in which certain individuals are more or less likely to be influenced by social events, such as differential susceptibility theory (Belsky, 2013; Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Belsky & Pluess, 2009; Ellis et al., 2011) and biological sensitivity to context theory (Ellis & Boyce, 2008; Ellis, Essex, & Boyce, 2005; Ellis, Shirtcliff, Boyce, Deardorff, & Essex, 2011). Both accounts involve a genetic predisposition characterized by heightened sensitivity of neural and/or physiological systems to environmental (including social) inputs which explains variability in the extent to which people react – physically, emotionally, and behaviorally – to life events or daily experiences. Other researchers have suggested more targeted mechanisms of sensitivity to the social environment. For example, the concept of rejection sensitivity (discussed further in *Individual Differences in Responses to Social Rejection*) depicts an individual difference factor that encompasses the propensity to perceive, anticipate, and react to social rejection (Downey & Feldman, 1996; Gao, Assink, Cipriani, & Lin, 2017).

That people are designed – by evolutionary processes – to be sensitive to the social environment has three critical implications for understanding responses to social threats like social rejection. First, people have an innate propensity to be deeply affected by social experiences. It is no accident that people experience strong reactions to these events, but rather, an evolutionary adaptation. Second, the responses people have to social experiences are also part of humans' basic and fundamental biological makeup. As such, they are relatively universal and automatic. Finally, that these social threats – and responses to them – are often highly impactful to developmental outcomes is also rooted in human evolution: on the whole, being shaped by social experiences has been beneficial to humans, which is why mechanisms that drive this influence have been perpetuated by evolutionary processes.

Being sensitive to social rejection experiences, in particular, also has an adaptive value: it conditions humans to avoid a significant threat to safety and wellbeing (explored further in subsequent sections of this report). Even though the manifestation of this evolved response is often a negative impact within individuals' lives, and responses often take the form of behaviors that seem maladaptive in a modern context (e.g., internalizing, withdrawal, and aggression), an evolutionary perspective – focused on population-level explanation – helps to clarify that there is, in fact, a good reason for these responses.

The Social Nature of Human Development

In a clear demonstration that "ontogeny recapitulates phylogeny" (Ernst Haeckel's biogenetic law, as cited in Barnes, 2014), human development, like human evolution, is

an inherently social process (Over, 2016; Rogoff, 2003; Tomasello, 2014). Many of the most foundational theories of human development have acknowledged this fact.

For example, Vygotsky's sociocultural theory of cognitive development depicted cognitive growth as a process that unfolds through interactions with more advanced members of the culture. He demonstrated how cognitive capacities – from language to logic – and physical skills result from learning processes[1] that cannot be divorced from the social and cultural medium in which they are learned. Vygotsky's theory also characterized the purpose of cognitive development as fundamentally social and cultural. Reminiscent of dual inheritance theory and the social brain hypothesis, Vygotsky described the purpose of cognitive development as the process by which people become competent individuals within their culture. Essentially, the goal of our cognitive capabilities is to enable our social nature towards social living within a particular society (Barrouillet, 2015; Lantolf, 2000; Saracho, 2021).

Bronfenbrenner's ecological systems model also views the nature of development as an inherently social and cultural process. He presented development as a process of continual interaction between a person (i.e., their biological and psychological characteristics, experiences, and motivations) and developmental processes (interactions with the environment such as playing with peers, discourse with parents, etc.), which are affected by the context in which they are embedded (e.g., social norms, culture), and which are situated within a specific time (e.g., phase of life, sociohistorical context). He

[1] For example, Vygotsky accounted for both implicit processes like modeling and explicit processes like guided participation or formal education in describing the sociocultural nature of human development.

outlined four concentric layers of the social environment (the microsystem, mesosystem, exosystem, and macrosystem) to describe how various aspects context shape human development. Importantly, Like Vygotsky, Bronfenbrenner viewed the human development as a process that not only *occurs within* a social environment, but as a process that is fundamentally *driven by* the social environment (Bronfenbrenner, 1977, 1986, 1994; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2007).

Early human ethologists, like Bowlby, also acknowledged the social nature of development in focusing on attachment relationships as the primary context for early development. Bowlby and attachment theorists like Ainsworth (Ainsworth, 1978; Bowlby, 1979) observed that humans are innately oriented towards and responsive to social cues and are, in many ways, pre-programmed with social behaviors. Although they focused on social interactions in the context of relations between infants and primary caregivers (generally mothers), they advanced the understanding of human social behavior by illuminating (1) that humans possess inborn circuitry to enable social behavior, (2) that many social behaviors and responses emerge very early in development, (3) that social relationships early in life (attachments) are critical to individuals' survival and success, and (4) that these early social interactions are foundational – they continue to influence subsequent social behaviors later in life (Ainsworth, 1978; Bowlby, 1979; Fletcher & Gallichan, 2016; Stevenson-Hinde, 2007).

Research has continued to confirm each of these basic tenants. Evidence of early development of the "social brain" – cortical regions involved in social perception, social cognition, and social information processing – indicates that even before birth, there are

systems in place that predisposed humans to attend to social cues like faces and eyes, and to process socially-relevant information from them, such as facial expression and eye-gaze (Adolphs, 2003; Farroni, Menon, Rigato, & Johnson, 2007). Young infants are also biased towards processing socially relevant sounds, such as those involved in language, even before birth (Gervain, 2018a, 2018b). Just days after birth, human infants can distinguish word-like sounds from non-word sounds emanating from other humans (May, Byers-Heinlein, Gervain, & Werker, 2011; Moon, Cooper, & Fifer, 1993). Within only a few months of birth, humans engage in clear social behavior – social smiling, laughing, and developing unique relationships with familiar individuals (Jones, 2008; Messinger & Fogel, 2007; see Over, 2016, for a review). Humans are social from the start.

Being social early in life serves humans well. Ethologists describe how early social relationships, specifically attachment relationships, improved the survival of human infants by ensuring that adults would be highly engaged in caring for them and protecting them (Goldberg, 2014; Simpson & Belsky, 2008). Attachments also have ancillary benefits, such as more access to language and other cognitive stimulation, that support human development (Goldberg, 2014; Martin, Ryan, & Brooks-Gunn, 2009; Simpson & Belsky, 2008; van IJzendoorn, Dijkstra, & Bus, 1995). Attachment relationships are also a primary context in which social expectations and behaviors develop; children learn from interactions with attachment figures how to interpret social cues, convey needs, express emotions, navigate social situations, and many other social competencies that become a blueprint for future social interactions (Ruhl, Dolan, & Buhrmester, 2015; Wong Konishi, & Cho, 2020). In addition to serving as a critical

foundation for the development of individuals, the biological drive to form attachments instills the human species with an innate motivation for individuals to connect, care for others, and transmit culture (Granqvist, 2021; Simpson & Belsky, 2008).

Throughout the lifespan, every aspect of human development is rooted in social processes, even those that may not seem overtly social. For example, although our brain can learn the meaning of many new words based on its own statistical processing, social cues like joint attention (Tomasello, 1992) and gestures (Kobayashi, Yasuda, & Liszkowski, 2022) are also critical to vocabulary acquisition. Social processes underlie humans' cognitive development well beyond language; reasoning and critical thinking are shaped by social interactions and learning processes derived from or directed by other humans (Lim, 2015; Manalo, Kusumi, Koyasu, Michita, & Tanaka, 2013; Oljayevna & Shavkatovna, 2020; Pascarella, Palmer, Moye, & Pierson, 2001). Humans learn moral reasoning (Walker, Hennig, & Krettenauer, 2000), develop a sense of self (Bohanek, Marin, Fivush, & Duke, 2006) and identity (Mclean & Pasupathi, 2012), learn new skills (Blevins-Knabe, 2016; Jones et al., 2011; Lee et al., 2014; McPherson, 2005) and acquire hobbies (Juvonen, Espinoza, & Knifsend, 2012; McPherson, 2005; Snellman et al., 2015), practice religion (Levy & Razin, 2012; Taylor, Chatters, & Brown, 2014) and develop a sense of purpose or meaning in life (Steger, 2012) – largely as a result of social processes.

Humans' dependence on other people for nearly every aspect of development highlights the centrality of our social nature; people evolved to interact with other people, but they also evolved to *need* to interact with other people. At the extreme, feral children,

who grow up outside of social groups with little to no human interaction, show markedly atypical development in language, cognition, social interaction, and mental health. Even with remedial support, they struggle to assimilate into mainstream society and have persistent deficits, which are exhibited physiologically and behaviorally (Dombrowski et al., 2011; LaPointe, 2005; Proverb, 2009; Šimunović, 2017). These cases demonstrate clearly that human development *requires* normative social inputs.

Even for children who develop within typical human societies, evidence from the study of child maltreatment exemplifies that there are developmental consequences – often severe – for children who lack positive and consistent social connections early in life. These experiences – the lack of expected social input – can alter the human brain and its functioning for the rest of the lifespan (Pollak, 2015; Teicher, Samson, Anderson, & Ohashi, 2016; Wilson, Hansen, & Li, 2011). Similar patterns have been observed for children who face interruptions to kep social inputs early in life, such as being removed from their biological parents and placed for adoption or in foster care (Puetz et al., 2014; Slavich et al., 2010).

Outside of the family context, children who experience high levels of social rejection or peer victimization (i.e., negative treatment from peers, including bullying behaviors) are at risk for long-term adjustment difficulties that are rooted in alterations to the physiological stress response and other biological factors (Carbone, 2019; McDougall & Vaillancourt, 2015; Reijnties, Kamphuis, Prinzie, & Telch, 2010; Zweirzynska, Wolke, & Lereya, 2013). Social rejection that is chronic or severe is also one of the most common characteristics of individuals who turn against human society by committing

atrocities such as mass shootings at schools; the effects of those social experiences on biological, emotional, and cognitive systems have been suggested as mediating mechanisms (Brodeur & Yousaf, 2020; Ioannou, Hammond, & Simpson, 2015; Kowalski et al., 2021; Sapru, 2019; Wike & Fraser, 2009). Together, the evidence clearly reinforces that typical human development is dependent on social inputs – positive, stable human relationships – and is profoundly, sometimes catastrophically, affected by disruptions to social needs.

Humans' Social Nature in the Modern Environment

Anthropological accounts have clearly documented the pervasiveness and common functions of social living, spanning from early human groups through modern day societies (Henrich & McElreath, 2007; O'Brien & Bentley, 2017; Söderberg, & Fry, 2016). Throughout human history, being connected to social groups has been a matter of life and death for humans. Integration in social groups provides advantages for survival and reproduction, and access to the material and social resources which support both (Henrich & McElreath, 2007; Söderberg, & Fry, 2016). Being disconnected from these social groups has posed a threat to biological success through the loss of these resources and protections (Sasaki & Uchida, 2013; Söderberg, & Fry, 2016). Considering the benefits of social integration (e.g., social capital) and the consequences of social isolation, both historically and in the modern social context, provides a clearer understanding of humans' social nature and why humans are so deeply motivated to detect and respond to social threats.

The Benefits of Social Integration: Social Capital. The role of social connections in human history cannot simply be boiled down to life and death; humans are motivated not just to live, but to prosper, flourish, and thrive. Humans are motivated to gain social status and resources; to outcompete others, be recognized for their triumphs, and enjoy the comforts and pleasures associated with life. Being connected to social groups is just as instrumental to these ends. That is, people mostly acquire these things through interactions with other people and from the benefits of social successes – by gaining friends and allies or by gaining dominance, power, or prestige. (Hawley, 1999, 2014; Hawley & Bower, 2018; Maner & Menzel, 2012; Pellegrini, Roseth, Van Ryzin, & Solberg, 2011).

In the thousands of years of human history, the fact that human "success" is contingent on social connections and social status in human groups has not changed. Even in a modern context, access to social connections and social networks is crucial to unlocking resources and opportunities to support life outcomes (Hawley, 1999, 2014; Hawley & Bower, 2018; Maner & Menzel, 2012). In fact, these social resources are so valuable in modern society that they are referred to as social *capital*. Access to social capital is a gateway to educational attainment (Cook, 2014; McDonald & Day, 2010; Smith, 2000), employment opportunities (Cook, 2014; Lin & Ao, 2008; McDonald, 2011; McDonald & Day, 2010; Smith, 2000; Son & Lin, 2012), physical health (Cook, 2014; Ferlander, 2007; Kunitz, 2004; Song, 2013), food security (Chhabra, Falciglia, & Lee, 2014; Choi & Kim, 2022; Walker et al., 2007), positive youth development (Hook & Coutney, 2011; Cook, 2014), social mobility (Chetty et al., 2022a, 2022b), wealth

(Chalupnicek, 2012; Fine, 2004; Orlowski & Wicker, 2015; Svendsen & Svendsen, 2003; Smith, 2000) and many other standards of success.

For those who do manage to access it, social capital can be a pathway to economic and social mobility (Chetty et al., 2022a, 2022b; Cook, 2014). For example, analyzing patterns of social connection via social media networks has revealed that for individuals with lower socioeconomic status, having a greater share of friends with high socioeconomic status on social media is one of the strongest predictors of economic mobility – ostensibly due to access to opportunities (e.g., education, job opportunities, advice, mentoring, coaching, etc.) provided by these affiliations (Chetty et al., 2022a, 2022b).

Modern society constricts access to this type of mobility-enabling social capital in predictable ways. Societies are structured – as a matter of law, policy, and social norms – to reinforce segregation between social groups, primarily on the basis of gender, race/ethnicity, and socioeconomic status (Bennett, 2017; Demanet & Van Houtte, 2013; Frankenberg & Taylor, 2018; Marcotte & Dalande, 2019; Mils & Roe, 2021; Quillan & Lagrange, 2016; Rukmana & Ramadhani, 2021). Segregation within and between schools is a key mechanism through which social class differences are perpetuated in today's societies: those who are disadvantaged by social systems in society are further restricted – beginning in their youth – from access to opportunities for social mobility (e.g., access to higher status connections, educational opportunities, job skill development; Bennett, 2017; Demanet & Van Houtte, 2013; Marcotte & Dalande, 2019; Nordowski et al., 2015; Patardy, 2013).

In the modern world, the difference between social groups that are privileged in a society versus those who are disenfranchised by it is largely rooted in access to social capital. In general, groups that enjoy privilege benefit from greater access to social capital and the opportunities that social capital offers, while the groups who are oppressed lack the same access to social capital, and, therefore, to the opportunities it provides. This disparity is a primary means through which societal inequality is perpetuated over time and across generations: a lack of social capital makes it difficult to attain economic resources, social status, or other types of power within society (Cook, 2014; Lin & Ao, 2008; McDonald & Day, 2010; Smith, 2000; Son & Lin, 2012).

That differences in social capital (and resource acquisition by extension) continue to distinguish social groups is consistent with the theory of multilevel selection (Gardner, 2015). Multilevel selection theory describes how evolutionary selection processes act on groups of people, as a unit, similarly to how natural selection processes act on the evolution of individual organisms. That is, groups of people can be – collectively – more or less successful or "fit" to withstand evolutionary pressures. Access to and control of resources can make groups more fit by enabling the survival or prosperity of individuals within the group. As such, groups are motivated to attain and maintain access to resources. Because of this, people are fundamentally hardwired to enact the social dynamics that concentrate privilege and power among certain groups while disadvantaging other groups; a multilevel selection perspective shows that these dynamics can be traced back to fundamental human motivation to ensure their group's survival, even at the expense of others groups. In fact, humans' tendency to act

preferentially towards their own group or even to disadvantage other groups in order to provide an advantage to their own group can also be viewed as a reflection of these innate biases that evolved to ensure the success of one's group. (De Dreu, Balliet, & Halevy, 2014; De Dreu, Gross, Farina, & Ma, 2020; Mead & Maner, 2012; Traulsen & Nowak, 2006). These ingroup-outgroup social dynamics – originally revolving around group fitness and resource competition – have contributed to the evolution and perpetuation of social rejection in human societies (see *Social Motivation in Multilevel Selection* for further discussion).

Humans may have internalized an urge to prioritize and support group-level fitness in an evolutionary context, but the importance of group-level wellbeing is not merely a relic of the past. Social capital remains an important predictor of group-level success. For example, societies with greater social capital tend to have economic advantages and be wealthier overall compared to societies in which people are less well-connected (Fine, 2004; Orlowski & Wicker, 2015; Svendsen & Svendsen, 2003). When challenges or disasters strike, even in the modern-day world, social groups with more resources tend to fair better than those without as many resources (Bergstrand, Mayer, Brumback, & Zhang, 2015; Carmen et al., 2022; Mayer, 2019; Ungar, 2011; Wickes, Zahnow, Taylor, & Piquero, 2015); once again, social resources are also key differentiator of this type of resilience. In fact, a large body of research has supported that communities with high rates of social connections and well-integrated social networks generally demonstrate better recovery from natural disasters (Adrich, 2017; Aldrich & Meyer,

2015; Mayer, 2019; Ungar, 2011) and even from the COVID-19 pandemic (Bartscher et al., 2021).

On the whole, research on social capital reveals that access to people is a powerful differentiator of "success" in modern society, both at a group level and at an individual level. Although there may have been some changes in the manifestation of the benefits of group living over time, modern human societies are still designed to encourage dependencies among people, to incentivize people to seek inclusion in groups, and to motivate people to connect with other people as a means of resource acquisition. As such, modern society both reflects and reinforces humans' social nature.

The Dangers of Social Isolation. In the context of evolution, being alone – ostracized or isolated from a social group – was a direct threat to survival (Söderberg & Fry, 2016; see Williams, 2002). Yet, many people fail to appreciate the extent to which this is still the case. Social isolation is still a mortality risk in today's societies (Bhatti & ul Haq, 2017; Cacioppo et al., 2015; Cacioppo & Hawkley, 2003; Cacioppo, Hawkley, Norman, & Berntson, 2011; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; House, 2001; Pantell et al., 2013). In fact, social isolation is just as predictive of mortality as traditional clinical risk factors like high blood pressure and smoking (Pantell et al., 2013). Underscoring the centrality of human connection to human functioning, research has found that perceived social isolation appears to be just as predictive of mortality as objective indicators of social isolation (e.g., living alone; Holt-Lundstad et al., 2015); put simply, *feeling* alone may be just as bad for human health and longevity as *being* alone.

From an evolutionary perspective, this is hardly a shock; humans have been conditioned and hardwired to respond strongly to social isolation because of the dangers it poses to the ability to survive and reproduce (Söderberg & Fry, 2016; see Williams, 2002). Even in a modern context, many of the same threats still apply. Many historical dangers, like the risk of malnutrition (Burris et al., 2021; McKenzie & Watts, 2020) or the risk of life-threatening injury[2] (Andrade et al., 2023; Close & Lord, 2022; Elliott, Painter, & Hudson, 2009; Kenny et al., 2010; Seil, Spira-Cohen, & Marcum, 2016; Turner et al., 2017), are still higher among those who are socially isolated. The threat of illness or disease is also greater among those who live alone (Cacioppo & Hawkley, 2003; Cacioppo et al., 2011). People who are socially isolated are less likely to have access to good health care and or to practice good health behaviors (Cook, 2014; Ferlander, 2007; Kunitz, 2004; Song, 2013) which compounds the health risks associated with social isolation further.

People who experience social isolation or loneliness (a subjective feeling of social isolation) are more likely to experience adverse health outcomes of all kinds, including higher rates of diabetes, hypertension, and cardiovascular disease (Cacioppo et al., 2011; Holt-Lunstad, 2021b; Holt-Lunstad, 2022b; Holt-Lunstad et al., 2015). They are more likely to die from complications associated with conditions like cardiovascular disease as well (House, 2001; Long et al., 2023; Spatz, Roy, Riley, Witters, & Herrin, 2023). Dementia and other forms of cognitive decline are also more common among those who

[2] For example, people who live alone are more likely to suffer serious injuries in the event of a house fire (Turner et al., 2017) or extreme weather events (Andrade et al., 2023; Kenny et al., 2010; Seil, Spira-Cohen, & Marcum, 2016). Older adults who live alone are at increased risk of injury or death due to falling (Close & Lord, 2022; Elliott, Painter, & Hudson, 2009).

are socially isolated or lonely (Bhatti & Ul Haq, 2017; Cacioppo et al., 2011; Holt-Lunstad, 2021b; Holt-Lunstad, 2022b; Holt-Lunstad et al., 2015).

Individuals who are socially isolated are also more susceptible to infectious diseases. They are more likely to develop symptoms of illnesses when exposed to viruses, and more likely to have a severe illness compared to those with stronger social connectedness (Cacioppo et al., 2011; Holt-Lunstad, 2021b; Holt-Lunstad, 2022b; Holt-Lunstad et al., 2015). Importantly, the heightened risk among those who are socially isolated is due to differences the strength of the immune response – which is much lower among those who are socially isolated – rather than differences in prior exposure (Cacioppo et al., 2011). In fact, those who are more socially connected appear to have stronger immune responses to brand new viruses compared to people who are socially isolated (Cacioppo et al., 2011; Holt-Lunstad, 2021b; Holt-Lunstad, 2022b; Holt-Lunstad et al., 2015). Depressed immune functioning appears to be pervasive: people suffering from social isolation and loneliness had a weaker antibody response to the COVID-19 vaccine (Gallagher, Howard, Muldoon, & Whittaker, 2022), and recover more slowly from illnesses and wounds (Cacioppo & Hawkley, 2003).

The immune system is not the only physiological system that does not function optimally when individuals experience social isolation. Metabolic systems, sleep regulation processes, inflammatory response systems, and multiple aspects of the stress response have also been found to be dysregulated among people experiencing social isolation or loneliness (Bhatti & Ul Haq, 2017; Cacioppo & Hawkley, 2003; Cacioppo et al., 2002; Cacioppo, et al., 2015; see Cacioppo et al., 2011 for a review). The body

exhibits disruptions to these processes in response to social pain that results from conflict or dissolution of meaningful relationships, but when social isolation becomes chronic or enduring, there appears to be a greater level and breadth of dysregulation to neuroendocrine, neurobiological, and genetic mechanisms (Cacioppo et al., 2015), which may help to explain, at a physiological level, why people may be motivated to restore social connection when it is interrupted. These functional changes also help explain the increased morbidity and mortality risk among people who experience social isolation (Cacioppo & Hawkley, 2003; Cacioppo et al., 2011 for a review).

Given that social isolation impacts stress response systems physically, it is not surprising that individuals who are socially isolated also tend to self-report greater levels of stress and discomfort in response to everyday stressors. They also exhibit greater stress reactivity in blood pressure fluctuations, indicating that the subjective intensity of the stress is mirrored in the biological response (Cacioppo & Hawkley, 2003). The impacts of social isolation and loneliness on cellular systems related to stress response activity (e.g., glucocorticoid gene modulation, proinflammatory upregulation of cytokine response) is also thought to be an underlying mechanism for the association between the lack of social connection and increased depression, cognitive decline, and sleep disturbance (Bhatti & Ul Haq, 2017; Holt-Lunstad, 2017; Leigh-Hunt et al., 2017; Murthy, 2023). These same physiological effects may also help to explain the heightened risk for suicidal ideation and suicide attempts among those who experience feelings of isolation and loneliness (Bhatti & Ul Haq, 2017; Murthy, 2023).

Taken together, the data paints a clear picture: people's physiological systems are innately prepared for living a social life and lacking those expected social connections is vastly disruptive to health and wellbeing – even on a physiological level. Despite profound changes to the conditions of group living in the modern world, people are still very vulnerable to the effects of isolation. The indication that isolation is still, in many ways, a mortal threat, contextualizes the problem posed by social rejection by clarifying that there is still an adaptive value to human's systems for detecting and reacting to social rejection in ways that are intended to improve social acceptance and inclusion, or at least minimize future rejection threats.

Social Motivation Systems

Given all the ways in which social isolation is experienced as aversive and physically detrimental, evolutionary theory would predict that organisms are innately motivated to avoid it, which certainly seems to be the case (see below, *Social Threat Detection & Responses to Social Rejection*). But in addition to a fundamental drive to avoid social isolation, people also have a corresponding motivation to *seek* social integration that is similarly consistent with an evolutionary account of social living.

Maintaining the social-cultural groups that facilitate the profound evolutionary success and progress demonstrated by the human species necessitates mechanisms for reinforcing social living; that is, to sustain and advance as theories of social evolution suggest, people have to be motivated to be part of groups. As it so happens, people are *very* motivated to be part of social groups. In exemplification of the innate desire for social integration, it is noteworthy that expulsion from social groups is an age-old

punishment among humans. Anthropological records are replete with examples of exile used in this manner throughout history and across societies from every corner of the world (e.g., Finnane & McGuire, 2001; Mackay, 2012; Oberg, 1934; Smith-Christopher, 2015). In contemporary society, exclusion is an explicit function of the criminal justice system (i.e., prison; Foster & Hagan, 2007; Galabuzi, 2004; Murray, 2007) but also an implicit social sanction that is imposed on those who do not abide by the social norms of prevailing society. For instance, among groups of adults, exclusion is a consequence for social loafing and other types of disruptive behaviors which threaten the norms of cooperation required to achieve group goals (Sasaki & Uchida, 2013; Kerr et al., 2009); among youth and adolescents, social exclusion is a consequence for the violation of peer group norms or gender norms that dictate acceptable behavior or appearance (Bennett, 2014; Kurzban & Leary, 2001; Wesselmann, Michels, & Slaughter, 2019).

It stands to reason that exclusion from social groups is an enduring and pervasive form of punishment in human society because it is effective. Indeed, people have strong reactions to social rejection. These reactions are often emotional and psychological, but they are also physical and physiological (see *Responses to Social Rejection*). Evolutionary perspectives justify that people are particularly sensitive to social rejection because it threatens the most basic drives: survival and reproduction. If social living evolved among humans because it conferred advantages (access to mates, protection, and other resources), then losing access to the social group entails losing these advantages – at great personal cost (Leary & Baumeister, 1995; Söderberg & Fry, 2016).

Even in modern society, access to resources is largely socially mediated. Most people gain access to food, water, power, and other basic amenities through other people, rather than directly from the environment (see *The Benefits of Social Integration: Social Capital,* in this report). Humans are no less dependent on other people in our current state than they were for the hundred thousand years preceding. This reliance on other people clearly imbues a motivation to be social: it is practical and advantageous to be socially integrated (Baumeister and Leary, 2017; Leary & Baumeister, 1995; Söderberg & Fry, 2016).

The Need for Social Connection

But humans are not merely rational creatures. As much as people are motivated by what is practical or, logically, advantageous, they are also – perhaps even more so – emotional creatures who are motivated by how they feel. As such, the evolutionary forces that impelled social living – and the modern social structures that reinforce it to this day – are perpetuated by a fundamental motivation to form and maintain social ties that is experienced independently of concepts of resources, risks, or benefits. People are *emotionally* motivated to affiliate with others and it is one of the most core features of human nature. This motivation is prominently featured in the foundational accounts of human needs (Erikson, 1950; Fiske, 2002; Maslow, 1970; Murray, 1938; Pittman & Ziegler, 2007). For example, Maslow (1970) famously stacked the need for love and belonging third on his hierarchy of needs, pre-empted only by physiological necessities (food, water, shelter) and physical safety.

Lending support to these theorists, the health consequences of social isolation demonstrate that social interaction is not ancillary or optimal for human functioning, but rather, necessary (e.g., Cacioppo et al., 2011; Holt-Lunstad, 2015, 2021a, 2021b, 2022a, 2022b). This evidence has led contemporary researchers in fields of psychology, neuroscience, neuroendocrinology, and public health to characterize humans as having a fundamental need for social connection. In this context, the need for social connection describes the basic drive to seek interactions and relationships with other people, and which is critical to human health and wellbeing. People who have strong social connections tend to be happier, healthier, and have higher survival rates (Alexander et al., 2021; Holt-Lunstad, 2018, 2021a, 2021b, 2022; Kagan, 2009; Rohrer, Richter, Brummer Wagner, & Schmukle, 2018).

We now know that the need for social connection is both deeper and wider than early evolutionary theories of human sociality account for. Notably, the need for social connection is not simply the need to be part of a family (e.g., Holt-Lunstad, 2018). Evolutionary theories originally mischaracterized humans' social nature by overemphasizing the importance of kin or familial relationships (Foster, Wenseleers, & Ratnieks, 2006; Taylor, Wild, & Gardner, 2007). Relationships with family members are clearly impactful, both in the sense of evolutionary fitness and in terms of contemporary human development. The importance of early attachment relationships is a clear exemplification (e.g., Goldberg, 2014; Granqvist, 2021; Gross, 2005). Of course, the contemporary conceptualization of a need for social connection certainly acknowledges the importance of relationships with family (e.g., Holt-Lunstad, 2018); in fact, a recent

142-country study of social connection found that, globally, social connections with friends and family are the most common source of social interaction on a daily basis (Meta-Gallup, 2023). However, people regularly interact with a range of types of social connections, including friends, people at work or school, neighbors, and many others (Holt-Lunstad, 2018; Meta-Gallup, 2022; Meta-Gallup, 2023) – any of these social connections can fulfill a need for social connection, offer social and tangible support, and contribute positively to health and wellbeing (Holt-Lunstad, 2018; Meta-Gallup, 2022).

Similarly, early evolutionary theory has also been criticized for being overly preoccupied with intimate or romantic relationships due to their relevance in the context for reproduction (Confer et al., 2010; Oesch & Miklousic, 2012; Shackleford & Liddle, 2014). Of course, the drives to reproduce and engage in sexual behavior have been recognized as a basic human motivation (Murray, 1938; Pittman & Ziegler, 2007) and romantic or intimate relationships are certainly among some of the most meaningful social connections that many humans experience (Jamison & Sanner, 2021; Roberson, Norona, Lenger, & Olmstead, 2018). Yet, friendships are also a key source of social support and are vital to wellbeing and development throughout the lifespan (Hartup, 2022; Hartup & Stevens, 1997).

The Need to Belong

In addition to the mountainous evidence that familial and romantic relationships are not the full story of human social connection, it is also clear that people are not only motivated to form dyadic bonds with other individuals; the need for connection also encompasses a need to be part of social groups, to have a sense of social connection at the

level of the neighborhood, community, society, and culture (Holt-Lunstad, 2018), which is why many have characterized this social motivation in terms of affiliation or belonging rather than a need for "relationships" or "social interactions" (Allen et al., 2021; Baumeister & Leary, 2017; Fiske, 2003; Leary & Baumeister, 1995; Maslow, 1970; Pittman & Ziegler, 2007).

In an evolutionary context, the need to belong serves a similar function to the more general need for social connection: it drives people to seek out, form, and maintain relationships with other people (e.g., Allen et al., 2021; Baumeister & Leary, 1995; Baumeister & Leary, 2017). Yet, according to researchers who study the need for belonging, the drive to form social connections does not fully explain humans' social motivation or behavior. The need for belonging – above and beyond the need for social interaction or relationships – helps to explain why humans do not break off into dyads or functional family units, but rather, even within these contexts, still seek to be part of social groups and communities, to form group identities and identify with larger collectives like cultures, countries, and religions. In many ways, a need for social connection only creates the building blocks for social living: an enjoyment of and desire for social interaction is necessary but not sufficient for group-living. The need for belonging is the glue that holds those blocks together to form society and culture (Allen et al., 2022; Baumeister & Leary, 2017; Boyd & Richerson, 2009; Leary & Baumeister, 1995). It is every bit as fundamental and influential as a need for social connection.

When a need for belonging is unmet, people often experience loneliness (Mellor et al., 2008), symptoms of depression (Wilczynska, Januszek, & Bargiel-Matusiewicz,

2015), and poorer overall life satisfaction (Mellor et al., 2008; Wilczynska et al., 2015). Feelings of belonging, or the lack there of, are also a highly salient feature of human's every-day lived experience: Baumeister and Leary (2017, p.508) point out that "many of the strongest emotions people experience, both positive and negative, are linked to belongingness." Indeed, most people can easily remember experiences of social rejection and inclusion from their past, and experience strong emotional and physiological responses to those recalled events (Bargh & Shalev, 2012; Baumeister et al., 2007; Gallo, smith, & Ruiz, 2003; Itzchakov et al., 2023; Kross et al., 2011; Ross & Inagaki, 2023; Twenge et al., 2007; Zhong & Leonardelli, 2008).

One startling demonstration of the power of these memories is the propensity for recalled social experiences to trigger feelings of physical warmth or coldness. People report feeling physical warmth when they recall feelings of belongingness, connection, and other positive social experiences (Bargh & Shalev, 2012), and report feeling physically cold after recalling social rejection experiences, even rating room temperatures considerable colder (Zhong & Leonardelli, 2008). Experimental evidence suggests that this link to temperature is not merely perception: Ijzerman and colleagues (2012) found that people who experienced acute social exclusion actually exhibited lower skin temperatures.

The Need to Belong – In a Changing World. Concerningly, researchers like Baumeister and Robson (2021) have noted that modern contexts for socialization, such as schools, may be becoming less conducive to meeting the need for belonging. They also suggest that incompatibilities between modern contexts and the social contexts of our

evolutionary past may pose difficulties to belonging needs in present day society. For example, there are far more individuals transitioning in and out of the social worlds of children today than in the past, partially due to factors like the drastic population increase in many human settlements (e.g., cities) and the profound mobility of modern humans due to transportation technology and globalization dynamics. This means that there is likely to be much more instability in social relationships in modern life (Baumeister & Robson, 2021), which threatens the ability for people to develop long-term lasting relationships fundamental to developing a sense of belongingness (Leary & Baumeister, 1995; Baumeister & Robson, 2021).

Furthermore, lower stability in social relationships entails differences in the developmental context for cultivating social skills. Individuals in contemporary society may have more need to develop social competencies necessary for forming relationships (e.g., self-promotion to make good first impressions) but less practice in the social competencies needed for maintaining long-term relationships (e.g., managing conflict). Experiences with the dissolution or termination of relationships are also likely to be more common today due to lower relationship stability. People make also be more likely to terminate friendships response to relational conflict in todays society due to a lack of relationship maintenance skills or due to the abundance of alternative social connections: there is not a necessity to preserve existing relationships when other relationships can easily be found (Baumeister & Robson, 2021).

Our modern social contexts, and school systems in particular, have organized socialization into same-age peer cohorts as a primary context of daily life experience,

further increasing the salience and impact of social experiences with peers (Baumeister & Robson, 2021). During the formative years of childhood and adolescence, experiences of social rejection and acceptance have profound implications for emotional wellbeing, future social behavior, sense of self and self-esteem, and nearly every other facet of development (Mulvey, Boswell, & Zheng, 2017; Williams, Forgas, & Von Hippel, 2013). It is no wonder that experiences of belonging and rejection feature prominently into individuals' personal narratives (stories about their lives) and the sense of meaning that people make out of their past experiences (Sommer, Baumeister, & Stillman, 2013). Strikingly, experiences of social rejection and alienation are one of the clearest defining features in the personal narratives of school shooters (Sapru, 2019).

Starting Life with Social Needs. An orientation towards seeking belonging and social connection is evident from the outset of the lifespan. Sensitivity to social cues, such as sensitivity to human faces and expressions or human speech and tone are online at (or before) birth, and truly social behaviors, such as social smiling and social attachments, emerge in the first weeks and months of life (see Over, 2016; see *The Social Nature of Human Development*). The tendency to attempt to elicit social responses and form social relationships in infancy has obvious implications for adaptive fitness: human infants compensate for their high degree of helplessness and vulnerability by engaging older, more competent individuals in fulfilling their needs (protection, physical nurturance, etc.). But early social relationships are more than simply conduits: infants seek out social interaction and display clear joy from it even when they do not need any physical needs fulfilled, and when this kind of meaningful positive social interaction is

absent in early life, the consequences for future development can be disastrous, even if physical needs are fulfilled (see Goldberg, 2014; Granqvist, 2021; Over et al., 2016).

Early in life, very young children also show a tendency to seek connection within social groups. For example, they naturally gravitate towards groups of peers, show signs of mimicking or matching their behavior to other group members' (van Schaik & Hunnius, 2016; Over, 2016), and demonstrate ingroup versus outgroup biases and loyalty to ingroups – even when the grouping is relatively arbitrary and short-lived (Over, 2016; Patterson & Bigler, 2006; Toppe, Hardecker, & Haun, 2020). Exclusion from social groups has serious consequences for adjustment – especially if prolonged or chronic – even in early childhood, consistent with the argument that responses to social threats innate (Godleski et al., 2015; Nergaard, 2020; Over, 2016.)

Physiological Implications of Social Needs. As evidence of physiological reactions to recalled social exclusion (e.g., decreased skin temperature; Zhong & Leonardelli, 2008) seem to suggest, the basic needs for social connection and belonging are embedded in humans' physical constitution. Research in social genomics has uncovered that social influences regulate individuals' gene expression, meaning that genes can be expressed differently when in the presence of others versus alone. There is also evidence of genetic responsiveness to differences in perceived social states, including perceived threats to social needs (e.g., loneliness or social rejection; Slavich et al., 2010; Slavich & Cole, 2013).

Indeed, there is considerable evidence that the human immune system functions differently when social belonging and connection are reduced, contributing to the

observed disease burden and early mortality associated with loneliness and social isolation (Bhatti & ul Haq, 2017; Holt-Lunstad et al., 2015; Pantell et al., 2013; Slavich & Cole, 2013; see *The Dangers of Social Isolation*), such as altered expression of proinflammatory cytokine genes and antiviral immune response genes. The general pattern of these biological changes has been summarized as the "conserved transcriptional response to adversity" because it involves a specific shift to upregulate some components of the immune system (e.g., proinflammatory) and downregulate other aspects (e.g., antiviral) that functions to prepare the body for exposure to dangerous environmental conditions (i.e., physical threats) by accelerating wound healing and reducing chances of infection (Leschak & Eisenberger, 2019; Slavich & Cole, 2013; Slavich, Way, Eisenberger, & Taylor, 2010; Smith et al., 2020).

There is ample evidence that bodily systems designed to address physical threats and injuries have been coopted to address nonphysical (i.e., social threats) among humans (see pain overlap theory, discussed further in *Responses to Social Rejection*; Eisenberger, 2012a, 2012b; Eisenberger & Lieberman, 2004, 2013; MacDonald, 2009). The immune system response appears to be yet another demonstration of this shared threat-response system. As a consequence, an immune response that would be adaptive to fighting direct bodily dangers from the environment is enlisted in the far-less adaptive context of social threats. The repurposing of this physical immune response helps to explain why people who experience social stress are at elevated risk for conditions that can are known to be related to inflammatory responses (e.g., cardiovascular disease, depression), and tend to

be more susceptible to viral infections (Leschak & Eisenberger, 2019; Slavich & Cole, 2013; Slavich et al., 2010; Smith et al., 2020; see *The Dangers of Social Isolation*).

Social modulation of gene expression is a powerful demonstration that the need for social connection and the need for belonging are biologically based and innate social motivation systems that have profound impact on human functioning. Yet, gene regulation is just one of many indications that humans' biological systems are fundamentally hardwired to seek fulfillment for these basic social needs and to detect and avoid social threats as a primary survival strategy (Slavich et al., 2010; Slavich & Cole, 2013).

Social Motivation in the Context of Multilevel Selection

Taking the perspective of multilevel selection theory (Gardner, 2015) elucidates additional explanations for humans' intense need for social connection and belonging. Having strong social relationships and being a part of social groups has clear benefits to individuals, and there are adaptive benefits for groups of organisms that are socially integrated (see *The Benefits of Social Integration: Social Capital*) and socially attuned to maintain that integration. The same social motivations that predispose people to the formation of social groups reinforce key social behaviors (such as communication, helping, cooperation, and altruism) that are critical to group functioning. These behaviors ensure that individuals are equipped to meet survival needs of their members by protecting one another, caring for members who are vulnerable (such as the young, old, injured, or ill), sharing knowledge, skills, information, and tangible resources; ultimately,

these behaviors mean that the group as a whole is more likely to survive threats and/or outcompete less cohesive groups (Boyd & Richerson, 2009; Traulsen & Nowak, 2006).

That individuals are motivated to maintain group living is the driving force behind the most unique capability that humans possess: the capacity for cumulative culture. The social-cognitive capacities that have facilitated and, in turn, evolved as a result of group living, such as social learning and cooperation, have allowed humans as a species to accomplish far more than isolated individuals or discrete family units ever could have, and far more than even other ultra-social species (Boyd & Richerson, 2009; Creanza et al., 2017; Henrich & McElreath, 2007; Mesoudi & Thornton, 2018; Russell & Muthukrishna, 2021; Tomasello, 2014; Traulsen & Nowak, 2006). The capacity for cumulative culture is believed to be related to both the scale of human social groups and the coevolution of general (non-social) and social intelligence (Boyd & Richerson, 2009; Henrich & McElreath, 2007; Mesoudi & Thornton, 2018; Russell & Muthukrishna, 2021).

The capacity for cumulative culture is not the only important implication of the social motivations that drive group living. The need to belong to social groups carries with it a strong sense of identification with the group(s) to which one belongs; people feel strongly about the group(s) they belong to, and readily draw a sense of personal meaning and identity from group belonging – all of which serves to reinforce the maintenance, cohesion, and prosocial functions within groups (Lambert et al., 2013; Wright, Aron, & Tropp, 2014). However, strong feelings towards ingroups are accompanied by strong feelings towards outgroups – of a very different sort. Reflective of a long history of

intergroup competition and conflict, people are predisposed towards feeling and behaving negatively towards outgroups (De Dreu et al., 2014; De Dreu et al., 2020; Mead & Maner, 2012; Traulsen & Nowak, 2006).

There are clear adaptive purposes for negativity towards outgroups as a human default: historically, it has paid off to be cautious about protecting group members and group resources by being wary, or even suspicious, of outgroups and outgroup members. In fact, the very presence of outgroups, particularly when there is the perception of ingroup-outgroup competition, strengthens the cohesion and prosocial nature of ingroup functions (De Dreu, Balliet, & Halevy, 2014; De Dreu et al., 2020; Mead & Maner, 2012; Traulsen & Nowak, 2006). Yet, the benefits of ingroup-outgroup dynamics on an evolutionary scale have created a tendency to construct ingroup-outgroup dynamics rather unnecessarily: people (implicitly or explicitly) define or strengthen their ingroup by defining and rejecting an outgroup; they seek their own belonging through rejection (Mead & Maner, 2012; Wright et al., 2014).

In modern contexts, this ingroup-outgroup dynamic can be exemplified by negative relations between different racial or ethnic groups, religious groups, or anyone who may be perceived as part of an "outgroup" (Brewer, 1999, 2007; Johnson, Rowatt, LaBouff, 2012), even between different social circles within schools and other social contexts (Abrams & Killen, 2014; Adler & Adler, 1995). As a consequence, people perceived to be part of the "outgroup" (or at least not part of the ingroup) may be ostracized or rejected. As such, the social motivation to belong is an explanation for what draws people together as well as what drives people apart.

Outgroups are not the only threat to the maintenance of social groups. While the need for belonging and social connection clearly motivates people to maintain groups, and individuals within those groups are certainly motivated to act in ways that build group cohesion (e.g., helping, cooperation, teaching/learning) for a number of reasons, people within groups can also act in ways that threaten group members or group cohesion. As will be further discussed in the following section, people have selfish motivations – a survival necessity – that can predispose them to behaviors that undermine group living, such as social loafing (Kerr, Seok, Poulsen, Harris, & Messe, 2008) or aggression (Barner-Barry, 1986). Maintaining group living necessitates that groups have ways of curbing behaviors that threaten group survival and reinforcing behaviors contribute to group survival.

The mechanism is a simple dynamic of "crime and punishment": all groups have a set of behavioral standards or rules for acceptable behavior in the group, *social norms*, and individuals who violate those norms (i.e., break the rules of the group) are punished (Hales, Ren, & Williams, 2017; Horne, 2001; Rudert, Keller, Hales, Walker, & Greifeneder, 2020; Söderberg, & Fry, 2016; Van Kleef, Gelfand, Jetten, 2019; Wesselmann, 2011). Although some have argued that these social sanctioning dynamics evolved specifically to address behaviors like social loafing and aggression that have clear relevance in evolutionary history (Gruter & Masters, 1986; Hales et al., 2017; Söderberg, & Fry, 2016), social sanctioning behaviors have become vastly generalized; resultingly, social groups readily "punish" rather mundane social norm violations (Hales et al., 2017; Horne, 2001; Rudert et al., 2020; Van Kleef et a., 2019). Anyone who looks

or acts differently may be at risk of social sanctioning (Rudert et al., 2020). This social regulation dynamic is so ubiquitous, including among groups of children and adolescents, that it has been termed the "misfit effect" (Wright, Giammarino, & Parad, 1986).

Importantly, the "punishment" for social norm violations generally involves inflicting social pain for infringements: ostracism, exclusion, and social rejection; peer victimization and bullying; loss of social status, friendships, or reputation have all been described as methods of social norm enforcement. Why social threats? Because they are effective. As the need for belonging and social connection imply, people are so inherently sensitive to social consequences that even the threat of them is enough to keep people in line (Gruter & Masters, 1986; Hales et al., 2017; Horne, 2001; Rudert et al., 2020; Söderberg, & Fry, 2016; Van Kleef et al., 2019; Wesselmann, 2011). Yet again, the social motivation to belong provides an explanation for the presence and prevalence of social threats as a pervasive fact of life.

The Selfish Side of Social Motivation Systems

As debates about the existence and origins of "true" altruism reveal, traditional theories of natural selection have emphasized that all behaviors and traits that have evolved in the human species must have some bearing on *personal* survival and/or reproductive success (Confer et al., 2010). Certainly, it is true that people have evolved behaviors and traits that enable self-preservation and self-promotion towards those ends (Alicke & Sedikides, 2009; Sedikides, Skowronski, & Gaertner, 2004), and those are just as relevant to understanding humans' responses to social threats. Examining these self-

serving motivations provides important contextualization for the basic social needs of connection and belonging.

Evolutionary explanations of the origins of basic social needs (i.e., connection and belonging) generally involve some reference to the benefits individuals derive from social relationships and membership in social groups (e.g., Allen et al. 2022; Baumeister & Leary, 2017; Leary & Baumeister, 1995). As definitions of "social capital" assert, other people confer a range of resources – emotional, informational, and tangible (Cook, 2014; Lin & Ao, 2008; Wickes et al., 2015). Thus, people are motivated to connect with other people and belong to social groups out of self-interest, as a means to obtain these resources (Hawley & Bower, 2018; Maner & Menzel, 2012). There are two (related) corollaries of this assertion: (1) if social connections provide access to resources, then more social connections means access to more resources; and (2) because resources are not evenly distributed within groups, being part of a group may confer some degree of access to resources, but it does not ensure maximal access to the resources within that group.

Starting with the first proposition, it is easy to understand how a summative property might drive individuals to seek a large number of social connections to maximize their access to resources. This helps to explain why individuals may seek multiple social connections (e.g., Holt-Lunstad, 2018; Maner & Menzel, 2012) and why threats to any (or multiple) of these relationships can be painful or damaging (Hawley & Bower, 2018; Maner & Menzel, 2012). Indeed, access to a wealth of social capital has benefits and those who are "socially central" within groups (i.e., connected to many

others in the group) tend to reap the rewards (Cook, 2014; Lin & Ao, 2008; Wickes et al., 2015).

Accordingly, and consistent with the second proposition, some group members obtain more resources within the group than others. As the first proposition implies, those who are more connected or *socially central* tend to receive more resources than those who are less well connected. People can be socially central for a number of reasons. For example, people who are well-liked have more friends and social connections (Cillessen & Marks, 2011; Litwack, Aikins, & Cillessen, 2012; Scott & Judge, 2009). Those who are perceived to be prestigious in some way (e.g., Badi, Li, & Pryke, 2016; Rusinowska, Berghammer, De Swart, & Gradisch, 2011) or have some degree of authority (Landsford et al., 2009; Medcof, 2001; Rodan & Galunic, 2004) or display a high degree of social dominance (Hawley, 2007, 2014; Hawley & Bower, 2018; Landsford et al., 2009; Pellegrini et al., 2011) also have greater access to resources within groups. The common thread is social status: individuals who obtain social status within the group through any of these means enjoy certain privileges (including resources) within the group (Hawley, 2014; Hawley & Bower, 2018; Maner & Menzel, 2012; Pellegrini et al., 2011).

Hawley (2001) presented an alternative, but complementary, account of how individuals obtain resources within social groups. Her explication of resource control theory posits that individuals can gain resources and social status via prosocial behaviors or through aggressive-manipulative behaviors; the most successful use a combination of both (i.e., the Machiavellian or bistrategic controller; Hawley, 2003). Importantly, these individuals are not just successful at gaining resources on a discrete occasion, but because

of their social position, have easy *ongoing* access to resources *as they are needed* (Hawley, 2014; Hawley & Bower, 2018; Maner & Menzel, 2012; Pellegrini et al., 2011).

The importance of social status in human groups bears resemblance to the role of social status among non-human animals. Social status is critical in driving the behavior of many other social species, such as other primates (Campos et al., 2020; Chiao, 2010; Wilson et al., 2008), canines (Peterson et al., 2002) and even some types of insects (Tsuji & Tsuji, 2005). Interestingly, social status may be rooted in similar neural and genetic factors across several species (e.g., serotonin transporter genes; Chiao, 2010). Although the social hierarchies of humans may be structured differently, the essential function is the same: those at the "top" gain access to resources.

In modern social contexts, perhaps the most salient form of social status – particularly in childhood and adolescence – is popularity. Popularity can either be conceptualized in the sense of people who are socially central because they are well-liked (i.e., sociometric popularity) or those who are socially central because they are thought to be prestigious (or "cool") and are admired or emulated (i.e., perceived popularity). Both forms of popularity confer social resources (Cillissen & Marks, 2011; Litwack et al., 2012; Pellegrini et al., 2011). Consistent with Hawley's resource control theory, some individuals who are perceived to be popular attain or maintain their social status through relational aggression. Relational aggression refers to behaviors that manipulate or harm other people's relationships, social status, or sense of belonging. Essentially, these individuals exploit others' fundamental needs for social connection and belonging for their own gain (Andreou, 2006; Hawley, 2003; Mayeux, 2014). Thus, the effectiveness of

inflicting social pain as a status-enhancing strategy also helps to explain the perpetuation of social threats among humans. It also further exemplifies the drive that individuals have to obtain social status within groups (and hence the benefits it entails) – even at the expense of others.

In addition to thwarting the need for belonging or social connection, some types of social threats directly attack individuals' social status as well. Two clear cases of this are peer victimization (being the recipient of negative treatment from peers) and social rejection[3]. Whereas other forms of social pain (dissolution of a friendship or death or a loved one) may involve damage to a specific relationship while leaving others intact, peer victimization and social rejection threaten individuals' social position more pervasively by demeaning, humiliating, or devaluing them. Threats to social status evoke strong emotional, physiological, and behavioral responses (Adler & Adler, 1995; Alder & Adler, 1998; Carney, 2008; Dulmus, Sowers, & Theriot, 2006; Espelage & Asido, 2013; Pronk & Zimmer-Gembeck, 2010; Sentse, Kretschmer, & Salmivalli, 2015). Although individuals vary considerably in their desire to gain high social status (e.g., social dominance orientation; Mayeux, 2014), most individuals are keenly aware of their social position and are deeply affected by it; it is core to how people see and describe themselves and their social worlds (Adler & Adler, 1995; Alder & Adler, 1998; Carney, 2008; Dulmus, Sowers, & Theriot, 2006; Espelage & Asido, 2013).

[3] It should be noted that social rejection, social exclusion, and ostracism can be considered as types of peer victimization when they occur within the peer group.

Social Threat Detection

To assert that humans have evolved fundamental social motivations to seek social connection, belonging, and social status requires that people have also evolved mechanisms to monitor the degree to which these needs are fulfilled and detect current or potential threats to their fulfillment. That is, similarly to how people feel hunger or fear to drive them to fulfill needs for nutrition and physical safety and to thus avoid starvation or bodily harm, social needs must have warning and alert systems (Kerr & Levine, 2008; Leary & Baumeister, 2000; Pickett & Gardner, 2005).

It may be argued that, to some extent, appraising the status of social needs may be part of the domain-general motivation system of emotion. Indeed, people are powerfully influenced by their emotions and quite a lot of human behavior is motivated by the drive to seek positive emotions and avoid negative emotions (Heckhausen, 2000). As discussed, it is also true that experiences of social inclusion or connection and experiences of social rejection or loss are often accompanied by strong emotional responses (see Baumeister & Leary, 2017; Leary & Baumeister, 1995). In fact, there are even emotions specifically oriented towards social states, such as loneliness (Cacioppo & Cacioppo, 2018). It is reasonable, then, to suggest that it is simply a matter of human's hedonic nature: people are motivated to seek inclusion and social connection as a means to attain positive emotional states and are motivated to avoid social rejection or other social threats to prevent the experience of negative emotions.

But several researchers have suggested that social rejection is so fundamental to human nature and evolution that more targeted mechanisms have developed to sense need

fulfillment and detect threats. Two of the most prominent are the Sociometer model (Leary & Baumeister, 2000) and the Social Monitoring System (Pickett & Gardner, 2005).

Sociometer Model

Leary and Baumeister (2000) described the function of self-esteem as an innate "sociometer" that developed to detect social threats. Specifically, they contend that because threats to belonging and social status are so critical to human survival and success, it necessitated a specialized system that is sensitive to the status of individuals' relationships and relational value. Self-esteem, by their account, serves to sense the degree to which individuals are "eligible" for lasting, positive relationships and membership in social groups, thus allowing people to gauge and maintain a necessary level of social acceptance (Leary & Baumeister, 2000).

According to this theory, the sociometer readily detects cues from the environment – specifically, other people – that indicate one's relational value. These cues may involve a wide range of social interactions, including the presence and nature of friendships or their absence; comments or behaviors that indicate how one is regarded by others; and the degree to which individuals' appearance and behavior aligns with social norms. However, Leary & Baumeister (2000) contend that this system is particularly sensitive to the detection of social rejection cues, whether they take the form of physical, verbal, paralinguistic, or gestural cues. Importantly, like other threat-detection systems, the sociometer is automatic and largely unconscious, allowing humans to maintain constant vigilance to protect against social threats (Leary & Baumesiter, 2000).

The description of the sociometer is consistent with other explanations of the function and evolutionary origins of self-esteem (e.g., Hill & Buss, 2013; Leary, 1999; Kirkpatrick & Ellis, 2003) and research on state and trait self-esteem appear to corroborate this function. For example, high levels of trait self-esteem are consistently related to indicators of high relational value, such as the presence of positive relationships, secure attachments, and popularity. In contrast low levels of trait self-esteem align with consistent experiences of relational devaluation, such as poor-quality relationships and attachments, social exclusion, and other forms of victimization (See Leary & Baumeister, 2000 for a review).

Additionally, threats to social needs (connection, belonging, and social status) are highly related to fluctuations in self-esteem (state; Leary & Baumeister, 2000; Williams, 2009; Williams et al., 2013) and reliably evoke actions that aim to restore self-esteem, primarily through social interaction, or self-preservation responses characterized by efforts to retaliate against others (i.e., a "fight" response) or withdraw from social interaction (i.e., a "flight" response; see Leary and Baumeister, 2000 for a review; see below, *Responses to Social Rejection*). Consistent with the case for the evolutionary function of the sociometer as a threat-detection system, the sociometer appears to be more sensitive to decrements than increments in social needs (see Leary and Baumeister, 2000).

Although self-esteem comprises a categorically unique motivation system, it is highly related to domain-general emotional and affect systems: trait levels of self-esteem correlate with overall emotional wellbeing and changes in self-esteem co-occur with

changes in affect as well (see Leary and Baumeister, 2000). There is also a high degree of concordance between self-esteem and depression (see Leary and Baumeister, 2000); low self-esteem is often considered both characteristic and predictive of depressive disorders (Sowislo & Orth, 2013).

Social Monitoring System

Like the sociometer, Pickett and Gardner's (2005) explanation of the social monitoring system also describes a constant, largely unconscious, threat-detection system specifically oriented towards social cues. The concept of the social monitoring system does not disregard self-esteem as an important social signal; instead it builds on sociometer theory to suggest that there are additional complementary systems that help to automatically orient individuals towards social information that is relevant to maintaining social needs, detecting social threats, and restoring social connection, belonging, or status after encountering a threat. In this way, the social monitoring system is a more comprehensive social needs fulfillment system that helps individuals successfully engage with and navigate their social environment (Pickett & Gardner, 2005, 2013).

Pickett and Gardner (2005, 2013) demonstrate that people are generally attuned to social information, which serves a range of adaptive purposes, but they are particularly sensitive to cues relevant to belonging, social connection, and social status. Importantly, there is also considerable evidence that people become *more* attuned to social cues when a threat or potential threat to any of these basic social needs is registered (see Pickett & Gardner, 2005, 2013). For example, people who experience acute social exclusion demonstrate greater attention to vocal tone and other paralinguistic signals (Pickett,

Gardner, & Knowles, 2004). People experiencing loneliness or low levels of belonging for any reason attend more to people's faces, eye-gaze, and vocal cues (Lodder et al., 2016; Gardner, Pickett, Jefferis, & Knowles, 2005; Wilkowski, Robinson, & Friesen, 2009). Chronically unmet belongingness needs and immediate experiences of rejection have also been linked to selective memory for social information (Gardner, Pickett, & Brewer, 2000).

From an evolutionary perspective, the adaptive value of the social monitoring system is three-fold: (1) the system allows individuals to automatically maintain constant monitoring of social information, (2) the system continuously filters and prioritizes information that is relevant to fundamental social needs (connection, belonging, and social status) in order to detect social threats, and (3) the system instinctively orients people towards the environmental input they need most in order to effectively respond to social threats (Pickett & Gardner, 2005, 2013). This third function of the social monitoring system is the main point of departure from Leary and Baumeister's (2000) sociometer theory; although sociometer theory acknowledges that individuals are motivated to restore self-esteem, it does not specifically propose the existence of mechanisms that facilitate successful restoration. Thus, social monitoring theory has additive value in understanding how people respond to and cope with social threats.

The Indiscriminate Early Detection System

Williams and Zadro (2013) also propose that humans possess innate systems for monitoring relevant social cues and detecting threats to social needs. Their account draws on similar evolutionary impetus as the sociometer and social monitoring systems to

explain the existence of specialized systems. However, rather than explaining the mechanisms of threat detection, Williams and Zadro (2013) focus on the process of threat detection. Like Leary and Baumeister (2000) and Pickett and Gardner (2005, 2013), they point out that there are a range of social cues that can trigger threat detection. Beyond the physical, verbal, paralinguistic, or gestural modes, these social cues can differ based on source, social setting, motivations, quantity and intensity, and clarity (see *Types of Social Rejection*), all of which are filtered through people's perceptual and cognitive systems. Individuals' appraisal of social cues, including their own social attributions, past experiences, and personalities also figure into whether and how a social threat is detected. Critically, not all behaviors that *can* be signals of social rejection are registered as such – certainly not by all people or in every situation (Williams & Zadro, 2013). Sociometer and social monitoring systems seem to imply some degree of universality in threat detection that Williams and Zadro's (2013) model clarifies; in many ways, this more nuanced perspective of social threat detection more closely aligns with human experience. For example, assumptions and interpretations, personality factors, past social experiences, and ambiguous motives are commonly described in recalled memories of rejection (Baumeister et al., 2007; Gallo et al., 2003).

Although subsequent sections will unpack individual differences in how people respond to social threats once detected (see *Individual Differences in Responses to Social Pain*), it is worth noting that the existence of individual differences in threat detection further supports that there are evolved mechanisms for threat detection. Natural selection requires inter-individual variation (Levins, 1963); people must have different levels or

types of sensitivity in detecting social threats – and some of those must be more adaptive than others – for a specific evolved system to develop. Williams and Zadro (2013) also suggest that individual differences in belonging needs and other traits (e.g., need for control, approaches to terror management, attachment styles) may also contribute this variability, which implies that rather than a single individual difference factor (i.e., some general "social threat detection" characteristic), there may be many heritable mechanisms that underly variation in and evolution of social threat detection.

Responses to Social Rejection

An evolutionary account of social rejection implies that humans have strong responses to social rejection that is distinctive from responses to other aversive events. Williams's need-threat model (Williams, 2009; Williams & Zadro, 2013) emphasizes that people's responses to social rejection, exclusion, and ostracism are unique from their responses to other types of social threats or aversive social experiences because of the pervasive impact on human's adaptive systems. Rejection experiences threaten multiple deep-rooted needs that are core to human functioning and survival, and because of this, people's immediate and long-term reactions are incredibly complex. Many controversies and apparent inconsistencies in physiological, affective, and behavioral responses to social rejection may be due to the involvement of multiple alert systems operating simultaneously. According to the need-threat model, in addition to threatening the need for belonging, social rejection can also threaten needs for self-esteem, control, and meaningful existence (Williams 2009; Williams & Zadro, 2013). The rationale for social

rejection as a threat to each of these four basic needs systems is reviewed below as context for examining physiological, subjective, and behavioral responses to rejection.

Belonging. The evolutionary and developmental significance of the need for belonging has already been extolled herein, but it is relevant to note that while many types of negative social experiences can threaten the belongingness, some types of experiences may constitute greater threats than others. In fact, Zadro, Williams, & Richardson (2005) identified that people perceive greater decrements in belonging in response to certain forms of rejection, namely those that can be characterized as exclusion or ostracism (e.g., being shunned or given the silent treatment), whereas interpersonal conflicts involving negative interactions (e.g., arguments) trigger threats to belonging to a lesser extent. Williams and Zadro (2013) propose that this is because exclusion and ostracism signal the total absence of belonging – and no clear outlet for re-engagement or restoration – whereas negative interactions still involve some degree of contact or potential for resolution.

***Self-Esteem*.** Consistent with the role of self-esteem as a mechanism of social threat detection, the need-threat model also contends that social rejection triggers a threat to self-esteem. Once again, there are many types of negative social interactions that can damage self-esteem, but social rejection may be particularly impactful because it is inherently a signal of relational devaluation (i.e., that one is not worthy or fit to be included). Furthermore, Williams and Zadro (2013) suggest that the effect of social rejection on self-esteem may be

especially impactful when there is a lack of clarity for the reason or motivation behind it, leaving the individual to make suppositions about why they have been deemed unworthy or unacceptable.

Control. People have a psychological need to perceive that they have at least some control over events in their lives; this is clear in clinical evidence that feeling a pervasive lack of control is characteristic of psychological disorders (e.g., depression; Yu & Fan, 2016) and is associated with maladaptive behaviors like poor self-regulation or self-harm (Lewis, Rosenrot, & Santor, 2011) or even violence towards others (Böckler, Seeger, & Heitmeyer, 2010). Williams (2009) and other researchers (e.g., Abrams, Weick, Thomas, Colbe, & Franklin, 2011; Lutz & Schneider, 2021) have identified that social rejection experiences are often accompanied by decreased feelings of having control in one's life and a diminished sense of having control over social events in particular. Yet again, negative social experiences involving exclusion or ostracism may be particularly threatening to this need because of the lack of ability to engage with those exacting it (Williams & Zadro, 2013).

Meaningful Existence. People have a basic psychological need to perceive that they are personally important and that their life is somehow meaningful. Terror management theory (Greenberg & Arndt, 2012) describes this need as a natural defense to compensate for the fear invoked by reminders of mortality, notions of the futility of existence, or any mere indication of personal insignificance. Williams (Williams, 2009; Williams & Zadro, 2013) argues that

> not only does social rejection inflict feelings of insignificance due to the meaning people ascribe to belonging and social group identification, but it is a very clear mortality salience cue as well. That is, he proposes that people are essentially hardwired to know the evolutionary cost of social rejection. Evidence of this is apparent in the relationship between the term for ostracism or exile (as exacted as punishment) and "death" in many lexicons (see Williams, 2012; Williams & Zadro, 2013 for reviews). Although other types of aversive social interactions may invoke feelings of insignificance, Williams contends that the evolutionary legacy and connotation make ostracism and social rejection unique triggers for threats to meaningful existence. Williams (e.g., Williams, 2009, 2012) and other researchers (e.g., Stillman et al., 2009; Twenge, Catanese, & Baumeister, 2003) have demonstrated that people who are excluded or rejected report feelings of being "invisible" or "unimportant" or other indications that their sense of having a meaningful existence has been diminished.

In addition to outlining these four needs systems that are uniquely threatened by social rejection and exclusion, the temporal need-threat framework (Wesselman, Hales, Ren, Williams, 2015; Williams, 2009) proposes that there may be a predictable pattern in the time-course of reactions to social threat experiences. The framework delineates between immediate reactions characterized by instantaneous aversive impacts (e.g., negative emotions and physiological arousal); short-term reactions geared towards restoring the four threatened needs (belonging, self-esteem, control, and meaningful existence); and long-term reactions which involve the internalization of the impacts on

these needs, and may include serious consequences such as social withdrawal, learned helplessness, and suicidality, especially if social rejection is prolonged (Wesselman et al., 2015; Williams, 2009; Williams & Zadro, 2012)

While the exact unfolding of this temporal pattern may not always hold true[4], this framework aptly characterizes responses to social rejection in three critical ways. First, the model incorporates elements of emotional responses, physiological responses, and behavioral responses – all of which have been well-documented and are critical to understanding the role of social rejection in daily life experience and human development. Second, this model is the first longitudinal framework for understanding responses to social rejection that accounts for how responses to rejection experiences may change over time; as such, it provides much-needed coherence among research on proximal and distal responses to social rejection. Finally, the model makes an explicit connection between how rejection is experienced and how people respond to it; using the four needs (belonging, self-esteem, control, and meaningful existence) as an organizing framework to explain why people may have the reactions they do also serves as a basis for more specific process models.

In recognition of the value of this model, the current research aims to elucidate the effects of social rejection on these basic needs, and to assess how changes in needs satisfaction relate to other responses (both physiological and subjective). As described by

[4] Note, for example, that immediate responses are not always characterized by negative feelings (see *Emotional Responses to Social Rejection*) and not everyone who experiences ostracism experiences the long-term or even short-term reactions describes at all; additionally, because individuals may experience social rejection often in daily life, there is not always clear delineation of these phases.

William's (2009) model, social rejection is expected to elicit reductions in feelings of belonging, self-esteem, control, and meaningful existence in the current study.

Hypothesis 1c: Social rejection will be associated with reduced needs satisfaction.

Physiological Responses to Social Rejection

It is no coincidence that descriptions of social pain often include analogies to physical pain. People readily describe "hurt feelings" (Leary, 2022; McDonald & Leary, 2005; Williams, 2007, 2009) and many other metaphors to physical injury to describe social pain: being crushed, stabbed in the back, slapped in the face, or having their heart broken (McDonald & Leary, 2005). A vast body of research, summarized as "pain overlap theory," demonstrates a high degree of concordance in bodily responses to physical and social forms of pain. Like physical pain, social pain – including social rejection – evokes activation of neural systems referred to as the "pain matrix" such as the dorsal anterior cingulate cortex and anterior insula (Chester et al., 2014; Eisenberger, 2012a, 2012b; Eisenberger & Lieberman, 2004, 2013; Eisenberger, Lieberman, & Williams, 2003; Lieberman & Eisenberger, 2006; Macdonald, 2009; Macdonald, Kingsbury, & Shaw, 2013; MacDonald & Leary, 2005; Masten, Morelli, & Eisenberger, 2011; Riva, Wirth, & Williams, 2011; Rotge et al., 2015). Additionally, substances that modulate the body's physical pain response (e.g., acetaminophen, the active ingredient in well-known pain relievers like Tylenol) also mitigate social pain (DeWall et al., 2010; DeWall, Pond, & Deckman, 2011; Kozel, 2016), further supporting the shared physiological mechanisms for physical and social pain responses. Hence, the term "social pain" is meant literally rather than figuratively.

As may be expected, the human body has evolved defenses against pain, which help to protect against the experience of pain to better enable adaptive responses to threats (e.g., fight or flight). At face value, it may seem counter-intuitive to suggest that there are innate mechanisms to "override pain" given that pain itself is an evolved mechanism meant to motivate self-preservation behavior (i.e., avoidance of harm and restoration of health). However, consider that in more extreme cases, humans are better able to protect themselves, seek safety, or otherwise address the source of the pain if they are not immobilized or hampered by the sensation of pain. Thus, a critical component of the physical pain response is the pain-alleviating endogenous opioid system. fMRI and bio-tracing studies have shown that the endogenous opioid system can also be recruited as part of the social pain response and serves a similar analgesic function (Ballantyne & Sullivan, 2017; Hill et al., 2022; Hsu et al., 2013; Slavich, Tartter, Brennan, &Hammen, 2014; Way, Taylor, & Eisenberger, 2009).

But the experience of pain (and its mitigation through the defensive analgesic response) is only one dimension of the body's adaptive response system for coping with social rejection, just as it is only one component of human's innate mechanisms for coping with physical threats. Humans also demonstrate an adaptive immune response pattern when confronted with physical threats. This immune response, characterized by upregulation of the pro-inflammatory (e.g., cytokine) response and downregulation of the antiviral response has also been found to be elicited by social threats, including experiences of social rejection (Conejero et al., 2019; Denson, Spanovic, & Miller, 2009; Eisenberger et al., 2009; Hawkley et al., 2007; Kemeny, 2009; Leschak & Eisenberger,

2019; Slavich, O'Donovan et al., 2010; Slavich, Way et al., 2010; Williams & Nida, 2022; Woodyatt & Wenzel, 2013).

Like physical threats, social threats also activate the body's stress response systems. The hypothalamic-pituitary-adrenocortical (HPA) axis is a primary modulator of humans' homeostatic functions and a core adaptation for confronting stressors. The HPA axis involves ongoing feedback systems among neural and hormonal systems, which allows continuous responsiveness of internal systems to environmental stimuli. The HPA system modulates cortisol levels and has broad effects on a vast range of processes, including metabolic, immune, and regulatory functions. It also affects many aspects of emotion, behavior, and cognition. Although cortisol levels rise and fall in a predictable circadian rhythm, acute elevation in cortisol levels is a hallmark of the HPA response to stressors. Chronically high levels of cortisol are common in people enduring chronic stress, which helps to explain many of the damaging effects of chronic stress on cardiovascular, cognitive, and other aspects of health (Kudielka & Kirschbaum, 2005).

The HPA axis, like other human systems attuned to environmental conditions, is responsive *social* stressors, including social rejection (Beekman et al., 2016; Blackhart, Eckel, & Tice, 2007; Dickerson & Zoccola, 2013; Gunnar et al., 2003; Jobst et al., 2015; Linnen et al., 2012; Peters, Riksen-Walraven, Cillessen, & de Weerth, 2011; Slavich, O'Donovan et al., 2010; Stroud, Salovey, & Epel, 2002; Zwolinski, Maroof, Weik, & Deinzer, 2010). Although many studies have focused on the acute effects of rejection among adults or college students in laboratory settings, studies of children in naturalistic settings support that chronic peer rejection is associated with elevated cortisol levels

(e.g., Gunnar et al., 2003) or dysregulation of typical cortisol responses and cycles (Peters et al., 2011; Wright & Bukowski, 2021).

In addition to HPA activation, social stress can also activate the autonomic nervous system. The autonomic nervous system is involved in the regulation of the body's involuntary functions such as heartrate, respiration, and digestion that can help prepare the body to respond to stressors, such as by increasing blood and oxygen flow and inducing metabolic processes to increase energy availability. One common (and easily measurable) biomarker of this process is the production of alpha amylase, which is involved in the digestion of starches (see Ali & Nater, 2020). Elevated alpha amylase levels have been linked to social stress experiences (Nater et al., 2006; Rudolph, Troop-Gordon, & Granger, 2010), including acute social rejection and exclusion (Bass et al., 2014; Helpman et al., 2017).

Although there is indication of multiple physical responses to social rejection, due to the well-known implications for physical and mental health, the current study assesses physiological responses to social rejection through analysis of salivary cortisol responses.

> ***Hypothesis 1a****:* Social rejection will be associated with increases in cortisol levels following the rejection experience.

Emotional Responses to Social Rejection

Given that social rejection threatens fundamental needs, it may be expected that people experience negative emotions when confronted by it. Indeed, Williams' temporal need threat model (Wesselmann et al., 2015; Williams, 2009) details "bad mood" and

"hurt feelings" as key elements of individuals' immediate response to rejection. In several experiments of social exclusion or ostracism, he and his colleagues have demonstrated increased levels of negative affect and negative mood states (Wesselmann et al., 2015; Williams, 2007, 2009; Williams et al., 2013; Williams & Zadro, 2013). Other researchers have found similar effects of acute rejection experiences in laboratory studies (e.g., Beekman et al., 2016; Gallegos & Gasper, 2018; Helpman et al., 2017). Wang and Li (2022) used an experience-sampling methodology to demonstrate that negative affect often accompanies experiences of social rejection in everyday life as well.

Leary (2022) reviews evidence and theory indicating that individuals' primary emotional responses to social rejection experiences – as a fundamental threat to belongingness and, specifically, one's relational value – consist of seven social emotions: shame, guilt, jealousy, embarrassment, social anxiety, loneliness, and "hurt feelings". He suggests that what is often measured as elevated levels of sadness and/or anger are ancillary to these emotions: they may be responses to situational aspects of the rejection experience or they may be misattributions or mischaracterizations of the primary experiences of those seven social emotions. Leary argues that – like self-esteem – social emotions have evolved specifically to allow humans to navigate their social environment; having specific types of emotions related to social events is more socially adaptive thnt only having domain-general (e.g., sadness, anger, fear) emotions. Importantly, the social emotions he describes are also widely regarded as negative emotional states and are thus consistent with Williams' temporal need-threat model in asserting that negative emotion is a primary response to social rejection.

With the sheer number of studies across multiple experimental and non-experimental methodologies reporting emotional distress associated with social rejection, it can hardly be dismissed as a feature of the social pain response. However, negative affect is not always reported in conjunction with experiences of social rejection. In fact, several studies have identified a very different response: rather than increased negative emotion, people evidence "affective flattening" following social rejection experiences (Bass et al., 2014; Baumeister et al., 2007; Bernstein, 2010; Blackhart, Nelson, Knowles, & Baumeister, 2009; DeWall, 2009; DeWall & Baumesiter, 2006; see DeWall, Baumeister, & Masicampo, 2009). In fact, a meta-analytic review of 192 studies of social exclusion found that affective flattening better characterized the aggregated evidence (Blackhart et al., 2009).

Consistent with the physiological and neural evidence of the social pain response, researchers have explained this affective flatting as an emotional "numbing" response or "emotional analgesia" (Bass et al., 2014; Baumeister, DeWall, Mead, & Vohs, 2008; DeWall & Baumeister, 2006; DeWall et al., 2009; McDonald & Leary, 2005) and point to evidence that it tends to co-occur with other indicators of an analgesic response such as decreased sensitivity toward others' pain (i.e., empathy; DeWall & Baumeister, 2006), decreased sensitivity to physical pain (DeWall & Baumeister, 2006; McDonald & Leary, 2005), and decreased sensitivity to temperature (McDonald & Leary, 2005). This characterization is reflective of the way that people often experience rejection as well: people who experience social rejection often self-report feeling "numb" in response (Gallegos & Gasper, 2018).

Neural and physiological evidence of endogenous opioid system involvement in the social pain response has also been found to correlate with evidence of emotional distress (or lack thereof) in social rejection responses (e.g., Ballantyne & Sullivan, 2017; Bernstein & Claypool, 2012a, 2012b; DeWall et al., 2010; DeWall et al., 2011; Hill et al., 2022; Hsu et al., 2013; Slavich et al., 2014; Way, Taylor, & Eisenberger, 2009). Similarly, the use of substances that modulate the physical pain system are also implicated in affective responses: administration of acetaminophen is associated with decreased negative emotion following rejection (DeWall et al., 2010; DeWall., 2011; Slavich, Shields, Deal, Gregory, & Toussaint, 2019) and the use of non-prescription opioids is also related to dysregulated social pain responses (Kroll et al., 2019). Acetaminophen may also reduce empathy towards the pain of others (Mischkowski, Crocker, & Way, 2016) and other forms of psychological pain (DeWall et al., 2011), suggesting that activation of the endogenous opioid system in response to social rejection is associated with more pervasive emotion modulation processes that broadly defend against the experience of emotional pain.

Interestingly, some research has demonstrated that responses may differ based on the type of social rejection; different experimental manipulations of social rejection – that vary in important features of the rejection experience (source, modality, etc.) – elicit different emotional responses: some elicit emotional distress and others elicit emotional flattening (Bernstein, 2010; Bernstein & Claypool, 2012a, 2012b; DeWall, 2009; DeWall et al., 2009). Researchers have pointed out that this apparent inconsistency is also observable in responses to physical pain: while minor injuries (e.g., papercuts, stubbed

toes) often produce a strong sensation of physical pain, extreme injuries (e.g., broken bones, dislocations) often do not produce a proportional pain response (at least not at first) due to recruitment of the endogenous opioid system as a defensive adaptation that ameliorates pain, temporarily, allowing people to seek physical safety via fight or flight responses. Only serious injuries invoke this response. Thus an apparent paradox in pain responses to physical injury may be attributable to the type or extremity of the injury. So too may responses to social pain: people may display differing levels of social pain following social injury (e.g., social rejection) depending on the activation of the endogenous opioid system. Furthermore, the type or severity of the social injury might account for differences in whether or not a defensive analgesic response is triggered (Bernstein & Claypool, 2012a, 2012b).

Although social rejection may be associated with either negative mood or flattened affect, reduced positive mood generally accompanies either response (Bass et al., 2014; Bernstein & Claypool, 2012a, 2012b; see et al., 2009), indicating that it is a relatively consistent feature of social rejection responses. Thus, it is expected that social rejection will elicit a decrease in positive emotion, regardless of the specific rejection experience.

Hypothesis 1b*:* Social rejection will be associated with decreased positive affect.

Behavioral Responses to Social Rejection

Given the effects of social rejection on physiological and emotional response systems, it stands to reason that peoples' behavior is also influenced by experiences of rejection. Yet, the nature behavioral responses to social rejection remains an open

question despite many years of study. The reason for this is an apparent discrepancy in the evidence: there is consistent replication of evidence in two [seemingly] opposing directions. One body of research has identified that people who have been rejected seek reconnection through prosocial behaviors. On the other hand, there is also a mountain of evidence that people who have been rejected act aggressively or hostilely, or with other types of antisocial behavior that seem to suggest a retaliatory motivation. Below, both sides of this behavioral paradox are discussed in more detail.

Prosocial Behavior. From a theoretical perspective, the idea that people will seek to restore their relational value or sense of belonging by trying to reconnect with other people following an experience of social rejection makes intuitive sense. A motivation to restore social connection is also consistent with the description of the social monitoring system and corresponding evidence that people become more attuned to social cues like eye gaze and vocal tone following acute rejection (Bernstein et al., 2008; Boas, 2010; Böckler, Hömke, & Sebanz, 2014; Pickett et al., 2004). Supposedly, this heightened social sensitivity should help people to navigate the social environment to better retore social connection. For example, Bernstein and colleagues (2008) supported the adaptive nature of these responses through a demonstration that excluded participants could better differentiate between real and fake smiles due to greater processing of facial expression cues.

There is also evidence that people who are rejected engage in increased sharing (Killian et al., 2023), positive approach behaviors (Dodge, Coie, & Brakke, 1982; Maner et al., 2007), volunteerism (Tai, Zheng, & Narayanan, 2011) and other prosocial

behaviors (Debono, Corley, & Muraven, 2020; see Blackhart, Baumeister, & Twenge, 2006), such as rewarding others (Baillet & Ferris, 2013; Maner et al., 2007) and increased effort in group tasks (Williams & Sommer, 1997). Rejection experiences have also been linked to greater interest in seeking social connections (Maner et al., 2007; Molden et al., 2009) and cognitive strategies focused on re-inclusion, such as contemplating elements of the rejection experience and how to remedy it (Molden et al., 2009; Williams, 2009). In fact, people are so desperate to restore their sense of belonging after rejection experiences that they subconsciously gravitate towards crowds (Thomas & Saenger, 2020), selectively buy products that are symbolic of group membership (Mead, Baumeister, Stillman, Rawn, & Vohs, 2011), and demonstrate a preference for anthropomorphic products or brands (Chen, Wan, & Levy, 2017; Mourey, Olson, Yoon, 2017).

The desire for reconnection may also explain evidence of an association between social rejection experiences and increased compliance or obedience (Carter-Sowell, Chen, & Williams, 2008; Riva, Williams, Torstrick, & Montali, 2014). Self-silencing, a pattern of subverting conflicting opinions or preferences, and other forms of ingratiating behaviors intended to please other people – including the perpetrators of the rejection – has also been evidenced (Harper, Dickson, & Welsh, 2006; Romero-Canyas et al., 2010; Romero-Canyas, Redy, Rodriguez, & Downey, 2013). When people are rejected, they demonstrate greater levels of behavioral mimicry (e.g., in food choices and spending behaviors, Mead et al., 2011; in facial expression, nonverbal, and verbal behaviors; Cheung, Slotter, & Gardner, 2015; Lakin & Chartrand, 2005), which is an evolved social contagion mechanism for establishing social connection. Concerningly, people who are

rejected are more likely to report willingness to engage in even unhealthy or risky behaviors (e.g., illegal drug use) if it may confer opportunities for social connection (Mead et al., 2011). Overall, rejected individuals are more socially susceptible and apt to try to please others or "fit in" through conformance: whatever it takes to reconnect and restore social needs.

Antisocial Behavior. Yet despite the considerable evidence that rejected individuals attempt to reconnect, a recent meta-analysis found that, on the whole, rejection experiences were more likely to predict declines prosocial behavior and increases in aggressive or antisocial behaviors (Quarmley et al., 2022). A plethora of evidence has indicated decreased prosocial behaviors like helping, sharing, or cooperating (Coyne, Gundersen, Nelson, & Stockdale, 2011; Twenge et al., 2007), increased retaliatory behavior in social games (Ayduk, Mischel, & Downey, 2002; Geniole, Carre, & McCormick, 2011; Twenge et al., 2007; Will, Crone, Van Lier, & Güroğlu, 2016) and other antisocial or aggressive responses (Ayduk, Downey, Testa, Yen, & Shoda, 1999; Crescioni & Baumeister, 2009; Debono et al., 2020; Rajchert, Konopka, & Huesmann, 2017; Ren et al., 2018; Twenge & Baumeister, 2004; Twenge et al., 2001; Warburton, Williams, & Cairns, 2006), including a greater proneness to engaging in conflicts (Ayduk et al., 1999) in response to social rejection experiences.

Although there is certainly evidence of direct retaliation in experiments (e.g., Twenge et al., 2001; Twenge & Campbell, 2003), as well as expressions of retaliatory intent (e.g., Twenge & Campbell, 2003), there is also evidence that hostile or aggressive responses may become generalized. Evidence of displaced hostility following rejection

experiences has been demonstrated numerous times; individuals who are rejected will readily display retaliatory or aggressive behaviors against individuals who were clearly not implicated as a source of their rejection experience (e.g. Rajchert et al., 2017; Twenge et al., 2001; Twenge & Campbell, 2003).

Research indicates that people who endure social rejection – especially chronically – are prone to a number of self-destructive behaviors (see Blackhart et al., 2006; Twenge et al., 2002), such as seeking pleasurable distractions like procrastination (Twenge et al., 2002), over-spending (Baumeister et al., 2008; Han, 2020) and overeating (Bicaker, Schell, & Racine, 2023; Oliver, Huon, Zadro, & Williams, 2001; Vanderwalle, 2016; Vanderwalle, Moens, Bosmans, & Braet, 2017). Yet, the tendency to engage in antisocial behavior is a particularly problematic manifestation of self-defeating behavior because it directly undermines the potential to restore social connection and belonging (Catanese & Tice, 2013; Maner et al., 2007; Twenge & Baumeister, 2004; Twenge et al., 2001). Maner and colleagues (2007) referred to the rejection-aggression link as the "porcupine problem" in acknowledgement that such responses serve to further deter social connection, thus exacerbating social threats rather than ameliorating them.

The porcupine problem explains the seemingly cyclical nature of rejection and aggression in naturalistic settings, especially among children and adolescents, whereby ongoing rejection is associated with aggressive responses that further promote negative reactions from peers (i.e. rejection) and perpetuate problematic social relations for victims of rejection (Lansford et al., 2009; Reijntjes et al., 2011). Indeed, aggressive behavior is a well-known risk factor for eliciting social rejection, exclusion, and peer

victimization (Bass, Saldarriaga, Velasquez, Santo, & Bukowski, 2022; Bass, Saldarriaga, Cunha, Chen, Santo, & Bukowski, 2018; Wright et al., 1986), as well as a response to social threats.

If antisocial responses to aggression are so self-destructive, why are they so prevalent? First, it is very likely that common emotion-aggression pathways may be a culprit. The relation between evoked hostility and antisocial responses suggests that emotions that add fuel to the fire may shape responses to rejection. Individuals who are rejected often show heightened levels of hostile emotions and hostile cognitions (Andrighetto, Riva, & Gabbiadini, 2019; Ayduk et al., 1999; Breines & Ayduk, 2015; Crescioni & Baumeister, 2009; DeWall et al., 2009; Miyagawa, 2023; Romero-Canyas et la., 2013; Reijntjes et al., 2011). DeWall and colleagues (2009) demonstrated that these hostile responses account for the link between social rejection and aggressive responses. Feelings of anger (Debono et al., 2020) and loneliness (Brinker et al., 2022) have also been found to underly aggressive reactions.

Impaired cognitive processes may also be at work. Experimental and neural evidence indicates that it takes effortful control to overcome the urge to retaliate in response to rejection (Balliet & Ferris, 2013; Will et al., 2016), which may involve unconscious and/or conscious processing of the conflict between an immediate temptation to lash out versus the long-term benefits of suppressing that impulse (Balliet & Ferris, 2013). Yet, when people are rejected, they are actually less equipped to exert this type of self-restraint or reasoning. Experiences of social rejection have been demonstrated to reduce capacities for self-control and self-regulation (Baumesiter,

DeWall, Ciarocco, & Twenge, 2005; Baumesiter & DeWall, 2005; Crescioni & Baumeister, 2009; Stillman & Baumeister, 2013); in fact, evidence of disregard for social rules of many kinds following rejection suggests a pattern of impulsivity and disinhibition underlying antisocial response to rejection (Poon & Teng, 2017). At the same time, logical processes and reasoning also seem to be impaired following rejection experiences (Baumeister, Twenge, & Nuss, 2002; Baumeister & DeWall, 2005; Stillman & Baumeister, 2013; Twenge & Baumeister, 2004); the higher-order processes that would generally be recruited to override aggressive urges may simply not be online.

These emotional and cognitive explanations seem to paint antisocial responses to rejection as inherently maladaptive. Yet an evolutionary theory of social rejection implies the opposite. That is, it is quite *adaptive* for organisms to evidence a "fight" response in reaction a threat as a means of self-protection. In fact, given that responses to social threats are essentially coopted systems for responding to physical threats (e.g., pain overlap theory, social stress responses), an evolutionary explanation for responses to social rejection that is consistent with this evidence would necessarily predict aggressive or retaliatory responses as an adaptive response for self-preservation (e.g., Archer, 2009; Sunami, Nadzan, & Jaremka, 2019). Additionally, aggression and other self-protective responses to rejection may be a learned response to cope with the social environment; research has demonstrated that during childhood and adolescence, chronically rejected individuals who attempt to establish social connections tend to be met with negative responses from peers (Dodge et al., 1982) and increases in rejection often precede increases in aggressive behavior (Hadelager et al., 2002).

An alternative explanation for the rejection-aggression link draws on evidence from social pain theory, indicating that emotional analgesic responses to social rejection not only numb pain caused by the rejection experience, but also reduce emotion systematically, leading to a reduction in interpersonal empathy (Crescioni & Baumesiter, 2009; DeWall & Baumeister, 2006). Indeed, there are shared physiological mechanisms for personal emotional responses and empathy responses, as exemplified by the analgesic effects of acetaminophen on both (Mischkowski et al., 2016). Coupled with evidence that many people show relatively consistent empathy gaps, a tendency to underestimate the pain experienced by others even when their empathetic response system is not impaired (e.g., in response to social pain; Masten et al., 2011; Nordgren et al., 2011), a further reduction in empathy caused by emotional analgesia may help to explain aggressive responses to social rejection.

Taken together, the evidence indicates a perfect storm for aggressive behavior in the wake of rejection. The usual cognitive and affective mechanisms that keep aggressive urges in check (e.g., self-regulation, reasoning, and empathy) are reduced, and the emotional impulses (anger, hostility) and physiological systems (e.g., stress responses) that impel aggressive behaviors are on high alert.

And yet, the fact that research also supports the potential for prosocial responses to social rejection raises questions about when and why prosocial versus antisocial responses may be triggered. A range of individual difference factors have been implicated to explain behavioral responses to social rejection (see *Individual Differences in Responses to Social Rejection* below). There is also evidence that differences in the

attributions people make for why they are excluded may determine the course of behavioral responses (Debono et al., 2020), which would be consistent with a social information processing perspective of aggression (e.g., Lansford et al., 2010)

Other researchers have pointed to situational rather than dispositional factors to account for the apparent discrepancy. For example, Warburton et al. (2006) present evidence that the degree to which a rejection experience is associated with a threat to the basic need for control (in addition to belongingness) underlies the tendency towards aggressive responses; people are more likely to respond with aggressive responses when their need for control is under attack. Alternatively, Molden et al. (2009) demonstrates reliable differences in behavioral responses to forms of social rejection involving direct, confrontational rejection versus exclusion via ignoring: specifically, the former elicits prevention-focused responses (e.g., antisocial responses) whereas the latter elicits promotion-focused responses oriented towards reconnection. This explanation is also consistent with pain overlap theory explanations which link the emotional analgesic responses of more severe social injuries with aggressive (prevention – "fight") responses and milder forms of social pain with restorative (promotion) behaviors (e.g., Bernstein & Claypool, 2012a, 2012b; Eisenberger, 2012a, 2012b; MacDonald & Leary, 2005; DeWall, 2009).

In addition to characteristics of the rejection situation, differences in the social situations following them may also determine behavioral responses in a manner that is socially adaptive. When those social situations present realistic opportunities for restoring belongingness, people may instinctively focus on seeking reconnection, but when there is

not a realistic chance of restoring social belongingness, people may allow their aggressive urges to get the best of them (Blackhart et al., 2006; Chen, DeWall, Poon, & Chen, 2012; Maner et al., 2007; DeWall & Richman, 2011; Twenge et al., 2001). In support, people are less likely to demonstrate aggressive behavior towards someone with whom they see potential for forming a social relationship, based on their compatibility (Chen et al., 2012) or based on signals of the other person's social receptivity (e.g., issuing of praise; Twenge et al., 2001) compared to people with whom they see no potential of having a future relationship (Chen et al., 2012) or who have shown no signs of interest in forming a connection (Twenge et al., 2001).

Although the exact reasons or mechanisms accounting for differences in behavioral responses are not yet clear, many explanations are rooted in physiological effects, emotional pathways, or specific triggered needs as underlying differences in behavioral responses. As such, rather than analyzing physiological and subjective (affect and needs satisfaction) responses as separate pathways, the current research will consider the interrelations among these factors as part of a comprehensive, multisystem response to social rejection.

Hypothesis 4: Physiological and subjective (affect and needs satisfaction) to social rejection are expected to be interrelated.

Individual Differences in Responses to Social Rejection

Although adverse reactions to social rejection are considered characteristic of human nature due to evolutionary selection processes, not everyone experiences or responds to social rejection in the same way or to the same extent. Research has

identified numerous factors that differentiate people's responses to rejection. Here I review some relevant evidence in the categories of physiological, cognitive, mental health, personality, experiential factors, and gender differences.

Physiological Variation. As previously explained, the human response to social rejection has a strong physiological basis, which suggests that alterations to any of these systems will be associated with variations in the response to rejection. Research has supported this conjecture, indicating that variations in the endogenous opioid system implicated in the social pain response (Amanzio, Pollo, Maggi, & Benedetti, 2001; Bonenberger et al., 2015; Bruehl, Burns, Gupta, Buvanendran, Chont et al., 2013; Bruehl, Burns, Gupta, Buvanendran, Passik et al., 2013; Way et al., 2009) or differences in HPA reactivity (Nowland et al., 2018; Takahashi et al., 2005; Villada, Hidalgo, Almela, & Salvador, 2016) are individual difference factors in responses to social threats. Similarly, genetic and physiological differences in the systems that modulate social stress and social pain processes are also implicated, such as differences in the oxytocin receptor gene (Auer, Burd-Craven, Grant, & Granger, 2015; McQuaid, Mclnnis, Matheson, & Anisman, 2015), MAOA gene (Eisenberger, Way, Taylor, Welch, & Lieberman, 2007; Gallardo-Pujol, Andres-Pueyo, & Maydeu-Olivares, 2013; Sebastian et al., 2010), serotonin receptor and transporter genes (Kretschmer, Sentse, Dijkstra, & Veenstra, 2014; Preller et a., 2016), and dopaminergic system (Janssens et al., 2015). There is also indication that the hormonal changes associated with pubertal development may impact responses to social rejection (Silk et al., 2014) and van der Meulen and colleagues (2018) found evidence that neural responses to social exclusion may be partially heritable.

Social Cognitive Factors. Elements of social-cognitive competencies have been implicated as risk factors for social rejection (e.g., impulsivity; Evans et al., 2015), but they also impact responses to rejection experiences – particularly aggressive responses. Researchers have found that biases in social informational processing systems predispose certain individuals to perceive or detect social rejection, even when it isn't intended (e.g., hostile attribution bias) and to respond aggressively to such threats, whether real or imagined (Claypool & Bernstein, 2019; DeWall et al., 2009; Dodge et al., 2003; Lansford et al., 2010; Martinelli et al., 2018; Moon & Lee, 2021; Reijntjes et al., 2011). Individuals also show consistent differences in cognitive coping mechanisms, such as the tendency to engage in positive reappraisal, in response to rejection experiences; differences in cognitive coping strategies can influence both short-term and long-term responses to rejection (Reijntjes, Stegge, & Meerum Terwogt, 2006).

Mental Health. Mental health conditions involve pervasive effects on physiological, behavioral, social, emotional, and cognitive functioning that impact responses to social rejection (Wirth, Lynam, & Williams, 2010; Reinhard et al., 2020). Reinhard and colleagues (2020) described the relationship between social rejection and psychiatric disorders as a "vicious cycle" in acknowledgement of role social rejection plays in the etiology and exacerbation of mental health disorders as well. Although altered processing of and responses to social rejection is observed in many disorders, depression and borderline personality disorder are particularly notable in these regards (Wirth et al., 2010; Reinhard et al., 2020).

Depression is one of the most prevalent mental health conditions in the United States, which disproportionately affects adolescents and young adults[5] (National Institute of Mental Health, 2023). Common symptoms and features of depression bear marked similarity to the basic needs threatened by rejection, including feelings of isolation or alienation (i.e., lack of belonging); feelings of low self-worth or low self-esteem; feeling out of control; and feelings of emptiness, hopelessness, and suicidality (i.e., lack of meaningful existence; Mayo Clinic, 2022). People who have a history of major depressive disorder or who are currently experiencing depression show greater neural, physiological, and emotional sensitivity to experiences of social rejection (Jobst et al., 2015; Kumar et al., 2017; Mo, Guo, Zhang, Xu, & Zhang, 2021; Silk et al., 2014; Slavich et al., 2010).

Although Borderline Personality Disorder is far less common than depression, affecting only about 1.4% of the adult population in the United States[6], sensitivity to threats of rejection is one of its hallmarks (National Alliance on Mental Illness, 2023). In fact, research on social rejection has demonstrated that people with borderline personality disorder show altered patterns of neural activation (Domsalla et al., 2014), detect and perceive rejection experiences differently (Chapman, Walters, & Gordon, 2014; Domsalla et al., 2014; Gratz et al., 2013; Jobst et al., 2014; Markham, 2003), and are more likely to show strong emotional and behavioral responses to social rejection (Chapman, Walters, &

[5] The rate of depression among adults 18-25 was 18.6% in 2021, which is more than twice the national average for adults that year, 8.3%.
[6] Though note that it is thought to be systematically underdiagnosed.

Gordon, 2014; Gratz, Dixon-Gordon, Breetz, & Tull, 2013; Jobst et al., 2014; Markham, 2003).

Past Experiences. Over time, peoples' social experiences influence their cognitive, behavioral, physiological, and affective responses to their social environment. As such, past experiences with parents and peers influence subsequent responses to social events like rejection. For example, interpersonal attachment moderates responses to social rejection (Fang, Hoge, Heinrichs, & Hofmann, 2014; Liddell & Courtney, 2018). At the extreme, individuals who have suffered severe forms of parental rejection or child abuse demonstrate particularly negative responses to rejection experiences later in life (Bolger & Patterson, 2001; Lev-Weisel & Sternberg, 2012; Van Harmelen et al., 2014).

There is indication that peoples' history of social rejection is particularly relevant in setting the stage for subsequent social threat responses. People who have experienced social rejection respond differently to a range of social stressors, including rejection (Kothgassner et al., 2021; Weik, Maroof, Zoller, & Deinzer, 2010; Will, Crone et al., 2016; Will, van Lier et al., 2016), and neural responses to social rejection are systematically different among individuals who have experienced chronic social rejection (Will, Crone et al., 2016; Will, van Lier et al., 2016).

In contrast, past social experiences – when positive – can actually reduce negative responses to subsequent social rejection. Positive social experiences, such as having friendships and spending time with friends, is associated with ameliorated responses to social rejection experiences (Bernasco, Van de Graaf, Meeus, & Branje, 2022; Doom, Doyle, & Gannar, 2017; Masten et al., 2012; McLachlan, Zimmer-Gembeck, &

McGregor, 2010; Peters et al., 2011; Quinlan et al., 2020; Tang et al., 2022). In fact, people may be able to better modulate their physiological and emotional responses to social events *in the moment* when they have the support of high-quality relationships. For example, Adams, Santo, and Bukowksi (2011) found that having a best friend present during a negative peer experience was associated with reduced cortisol reactivity.

Personality Traits. People show normal variation in many traits which confer variation in responses to social rejection. For example, low levels of trait self esteem – even when not associated with depression – are predictive of stronger physiological and emotional responses to social rejection (Kashdan et al., 2014; Onada et al., 2010). Similarly, non-pathological levels of narcissism correlate with a tendency towards hostile cognitions and retaliatory behavior in response to social rejection (Cascio, Konrath, & Falk, 2015; Moon & Lee, 2021; Twenge & Campbell, 2003).

Downey and Feldman (1996) proposed that "rejection sensitivity" itself is a personality trait which helps to explain the tendency to perceive and react strongly to social rejection (Auer et al., 2015; Ayduk et al., 1999; Downey, Lebolt, Rincon, & Freitas, 1998; Downey & Feldman, 1996; Gao et al., 2017; London, Downey, Bonica, & Paltin, 2007; Marston, Hare, & Allen, 2010; Romero-Canyas et al., 2010). The conceptualization of rejection sensitivity overlaps with the broader trait of fear of negative social evaluation; whereas rejection sensitivity focuses on susceptibility to a more selective set of social cues and social feedback (i.e., that which is related to rejection), fear of negative social evaluation describes a more general pattern of anticipating, perceiving, and reacting strongly to any kind of negative social cues or

feedback (including those related to rejection). Both constructs represent heightened attention to indictors of one's relational value and demonstrate similar physiological profiles (Kortink et al., 2018) and both are reliably linked to social rejection responses (Ali et al., 2021; Khanam & Moghal, 2012; Kortink et al., 2018; Pan-Ru et al., 2019; Tanaka & Ikegami, 2015).

Belongingness, or the need for social belonging, has also been described as a discrete personality trait (DeWall, Deckman, Pon, & Bonser, 2011) that broadly affects social functioning and behavior (Beekman et al., 2016; De Cremer & Leonardelli, 2003; DeWall et al., 2011; Tyler, Branch, & Kearns, 2016). Although a need to belong is relatively universal among humans, consistent with its evolutionary origins (Baumeister & Leary, 2017; Leary & Baumeister, 1995), there is evidence that a small minority of people do not feel drawn to socially connect with other people or groups and get little pleasure from doing so, not due to shyness or anxiety, but simply out of lack of interest. This type of asociality or social anhedonia is regarded as an aberration to the need to belong. It is commonly associated with adult-onset psychiatric disorders like schizophrenia (Brown et al., 2007; Kwapil et al., 2009; Silvia & Kwapil, 2011), but a similar tendency towards being "unsociable" can appear early in childhood (Bullock et al., 2020). At the other end of the spectrum, a high need for belonging can also be problematic, as it tends to predispose individuals to be susceptible to peer influence (including towards risky behaviors; Conigliaro & Ward-Ciesielski, 2023; Grinman, 2002; Litt, Stock, & Lewis, 2012) and strong negative responses to experiences of social rejection (Beekman et al., 2016; DeWall et al., 2011; Tyler et al., 2016).

Based on evidence of individual differences in responses to social rejection, it is expected that there will be individual-level variability in responses to social rejection in the current study.

Hypothesis 5a: There will be individual variability in cortisol responses to social rejection.

Hypothesis 5b: There will be individual variability in emotional responses to social rejection.

Hypothesis 5c: There will be individual variability in the degree of impact on basic needs satisfaction in response to social rejection.

Hypothesis 5d: There will be individual variability in behavioral responses to social rejection.

Furthermore, due to evidence that fear of negative social evaluation is broadly related to social responsivity and the physiological systems that modulate it, this study will test the role of fear of negative social evaluation as a personality trait that may help to explain this variability.

Hypothesis 5e: People who are high in fear of negative social evaluation will exhibit greater increases in cortisol in response to social rejection compared to people who are lower in fear of negative social evaluation.

Hypothesis 5f: People who are high in fear of negative social evaluation will exhibit greater affective responses to social rejection compared to people who are lower in fear of negative social evaluation.

Hypothesis 5g: People who are high in fear of negative social evaluation will exhibit greater reductions in basic needs satisfaction in response to social rejection compared to people who are lower in fear of negative social evaluation.

Gender. Evolutionary explanations for the origins of aggressive behaviors argue that women have a particular proclivity for indirect and relational forms of aggression due to its utility in intrasexual competition among women. That is, whereas men have historically used physical aggression, intimidation, and threats of violence to beat out other men for access to mates (and other resources), women use tactics that undermine the social status, social acceptance, or relational value of other women to achieve the same means. Behaviors like gossiping or spreading rumors, talking behind others' backs, the silent treatment, and other forms of social rejection often thought of as characteristic of women fit squaring in this category (Benenson et al., 2013; Bjorkvist, 2018; Campbell, 1995, 1999; Vaillancourt & Krems, 2018). Indeed, there is some evidence that women engage in more of this type of aggression in a number of settings, both naturalist and experimentally contrived, across most of the lifespan (Bjorkvist, 2018; Berenson et al., 2013; Campbell, 1995; McAndrew, 2014, 2017; Wright & Roloff, 2009).

Corollary to the assertion that women engage in more of this type of behavior and that it is largely directed at other women – as per its origins as a means of intrasexual competition as well as a function of having more interactions with same-sex individuals during much of the lifespan (Maccoby, 1995) – women should also have evolved heightened strategies for detecting and responding to social rejection as well (Benenson

et al., 2013; Campbell, 1999). Some research has indicated that women more sensitive to detecting social exclusion cues than men (Benenson et al., 2013), and display greater physiological responses to acute social exclusion than men do (Benenson et al., 2013; Stroud et al., 2002; Weik et al., 2010). Rejection has also been found to elicit greater levels of distress (Helpman et al., 2017), greater need to belong (Batara, 2014), and greater attempts to repair relational value after being rejected (Bozin & Yoder, 2008; Williams & Sommer, 1997) in women compared to men. Even in adolescence, girls and boys tend to display different patterns of coping, symptoms, emotions, and appraisals (Zimmer-Gembeck & Skinner, 2015).

Researchers have suggested that, apart from evolutionary explanations, gender ideologies, social status, socialization and other factors may be relevant in explaining these apparent gender differences in response to social rejection (Bozin & Yoder, 2008; Jackson, 1999). Additionally, it is possible that differences in responses to rejection may also be due to gender differences in the expression, functions, or meaning attached to rejection (Jackson, 1999).[7]

Types of Social Threats

Social threats can arise in a multitude of ways, and as discussed, humans' evolutionary legacy and the conditions of modern social life render social pain ubiquitous in daily life. This research focuses on social rejection because it is a type of social pain

[7] Note that while gender differences will be explored, there are no directional hypotheses for gender. This is due to the sampling strategy, which did not balance by gender, and resulting sample size for men in this study, which is likely to lead to underpowered analyses, given the relatively small effect sizes found in the literature. This is further discussed in the limitations section.

that threatens multiple social motivation systems (i.e. the need for belonging and social connection, and the drive to seek social status) and social needs systems (e.g., belonging, self-esteem, control, and meaningful existence) and has well-demonstrated implications for development.

Yet not all social rejection is the same. Humans readily characterize a vast number of types of social interactions as rejection. Among the many different behaviors that can signal rejection, some are physical in nature, involving bodily harm or physical intimidation, but many instances are verbal. Rejection can also be more subtle. For example, it can be communicated through paralinguistic cues such as a change in tone or wording (e.g., sarcasm) or through gestural cues and nonverbal behaviors such as eye-rolling or avoiding physical proximity. People can detect social rejection through any of these modes (Kerr & Levine, 2008; Williams & Zadro, 2013).

In today's modern context, a growing proportion of instances of social rejection also take place in cyberspace (Williams, Cheun, & Choi, 2000; Wang, Mu, Li, Gu, & Duan, 2020), including through social media (Galbava, Machackova, & Dedkova, 2021; Lutz & Schneider, 2021; Wolf et al., 2015). Technological modes have also opened the door to new phenomena in social rejection, such as the rise of "ghosting," a form of social rejection enacted by suddenly and inexplicably ceasing contact (typically through electronic modes of communication; LeFebvre, 2017; Navarro et al., 2020). Although some common modes of rejection, such as verbal forms, certainly take place via the internet, a range of additional forms of rejection cues have developed in this space, including cues that are graphic (e.g., pictures, memes) and symbolic (e.g., "likes";

Galbava eta al., 2021; Lutz & Schneider, 2021; Wolf et al., 2015). Some research has indicated that there are differences in how people perceive these types of cues which mirror differences in responses to in-person social rejection. For example, Lutz and Schneider (2012) found that being overtly rejected on social media (i.e., receiving "dislikes") was associated with greater reductions in self-esteem and belonging and a tendency to withdraw from further social contact, whereas being ignored on social media (i.e., receiving neither "likes" nor "dislikes") was associated with more attempts to reconnect (Lutz & Schneider, 2021).

Beyond cyberspace, Molden and colleagues (2009) demonstrated a similar distinction between responses to overt rejection versus being ignored: those who experienced direct rejection were more likely to engage in prevention-motivated behaviors (e.g., social withdrawal) whereas those who experienced being ignored were more likely to engage in promotion-motivated behaviors aimed at reestablishing social connection. Similarly, Bernstein and Claypool (2012a, 2012b) compared responses to two different types of social rejection using rejection paradigms common in extant literature. Specifically, they compared responses to rejection through the Cyberball paradigm (Williams et al., 2000), in which respondents are ignored during a virtual ball toss game (see *Experimental Manipulations* for more details), to rejection through a manipulation in which individuals complete a personality inventory and are told that their results indicate that they will end up alone without meaningful relationships (often referred to as the "Future Life" paradigm; see *Experimental Manipulations* section for more details). The authors identified that being ignored was associated with heightened physical and

emotional pain sensitivity, and greater reduction in feelings of belonging, self-esteem, and other basic needs. In contrast, being given feedback about impending future rejection was associated with reduced emotional and physical pain sensitivity, characteristic of an analgesic response (Bernstein and Claypool, 2012a, 2012b).

Drawing on pain overlap theory, Bernstein and Claypool (2012b) also demonstrated that the difference between the two paradigms and, and thus the experiences of being ignored versus being rejected, was a matter of *severity* in addition to mode. That is, the experience of being ignored in Cyberball was rated as a less severe social injury by participants, whereas being forecasted a future of rejection via the Future Life manipulation was regarded as a more severe social injury. This aligns with the involvement of the endogenous opioid system responsible for analgesic pain responses for physical pain, whereby the analgesic function is invoked exclusively to help the body cope with more severe injuries (Berenstein & Claypool, 2012a, 2012b; DeWall, 2009).

However, this explanation still raises questions about what makes social rejection "severe". Although the idea that "ignoring" may be less injurious than more direct forms of rejection seems like an intuitive explanation, it is worth examining further to consider what "severity" for a social injury really entails. For example, in one of the manipulations described by Molden and colleagues (2009), "ignored" individuals are left out of a conversation; the participants' views or ideas were not acknowledged and the other two individuals in the conversation proceeded to have a private conversation in which they share a social connection (living near one another). In contrast, during the "direct

rejection" form of the conversation, the participants' ideas and opinions were disparaged and the individual was directly verbally attacked for holding those views.

There are many potential differentiators in those experiences, beyond the passive vs. direct nature. First, the rejection condition includes explicit insults which may psychologically threaten participants in other ways (e.g., damaging their ego or self-esteem) meaning that their psychological responses to the experience is a reaction to being *both* rejected *and* insulted (i.e., adding insult to injury). Second, in the ignored condition, the motive for the exclusion could easily be perceived as ambiguous (no one says that they don't like the person or their ideas, or gives any reason why they are leaving the participant out) or coincidental (i.e., the other members of the conversation happen to have something in common; e.g. "it is not that they don't like me, they just like each other better"). However, in the rejection condition, the motive for the behavior is made clear, and it is specifically because of the participants' views and what those views say about them as a person. Thus, there are important differences in the clarity and nature of motives between the two scenarios. Third, as noted by previous research (Blackhart et al., 2006; Chen, DeWall, Poon, & Chen, 2012; Maner et al., 2007; DeWall & Richman, 2011; Twenge et al., 2001), there is evidence that the likelihood of prosocial or social approach behavior is constrained by the potential to form social connections. In the ignoring condition, the participant had no reason to believe that he or she could not form a social connection with the individuals in conversation, only that he or she hadn't managed to do so *yet*, hence leaving a door open to potential future connection. In contrast, in the rejection condition, the use of personal insults may have communicated

that the door to future connection was effectively closed, hence motivating a prevention rather than promotion mindset[8].

The other manipulations of direct rejection versus ignoring in the experiments conducted by Molden and colleagues (2009) use prompted recall of past real-life experiences. Specifically, experiences of overt rejection were prompted by asking participants to "think about a time in which you felt intensely rejected in some way . . . it must be a time that you were clearly rejected—where you were told you were not accepted because you were not wanted or liked" (p.420) and experiences of being ignored were prompted by asking participants to "think about a time in which you felt intensely ignored in some way . . . it must be a time that you were clearly ignored, but no one actually said that they did not want or like you" (p.420). Once again, the rejection condition includes an explicit and known motivation (i.e., "you were told) on the part of the rejectors that is directly hurtful and/or insulting ("you were not wanted or liked"), yet being ignored does not include an explicit or known motive nor does it involve an overt insult. It is easy to see from this difference alone why rejection may be perceived as a greater threat or injury. It is also not clear if there are other systematic differences between the recalled experiences, such as the situation, setting, source, or duration.

Many of these same differences can be found in the rejection versus ignoring paradigm explored by Lutz and Schneider (2021). For example, getting "dislikes" on social media sends a clear and explicit message of disapproval, provides a clear and

[8] Note that individuals were not given the opportunities to connect with individuals outside of the conversation paradigm, nor were they asked about any cognitions or emotions related to external opportunities for social connection.

personal reason for the disapproval (i.e., something the participant did or said online that received the dislike), and thus may be experienced as an insult and thus a threat to ones' ego and self-esteem in addition to threatening belongingness. In contrast, being ignored on social media is particularly ambiguous; it is difficult to tell why people are ignoring content: perhaps they don't like it, perhaps they don't want others to see that they like it; perhaps they just feel neutral about it or have conflicted feelings about it; perhaps they didn't notice it or were distracted while reviewing it. In any case, an explicit motive, message of disapproval, or insult are all absent, and the door is still open to getting attention and social connection. Hence, similar differences in the responses to direct rejection vs. ignoring to those uncovered in Molden et al (2009) may stem from similar features of the corresponding rejected versus ignored experiences.

The two studies conducted by Bernstein and Claypool (2012a, 2012b) comparing social rejection via Cyberball and Future Life manipulations point to additional potential differences in how characteristics of social experiences may be registered as minor versus severe social injuries. In general, the experience of Cyberball (being left out of a virtual ball-toss game) seems similar to the other paradigms reviewed as experiences of being ignored: it is passive, and there is no known motive, no direct message of disapproval, and no direct insult. The Future Life paradigm (forecasting a future of rejection based on a personality test) is quite a different beast. First, it is deeply personal. It provides a direct referendum on one's character (i.e., personality test results) as the reason for the rejection, insinuating that there is something about their personality that makes them unworthy or unfit for continued meaningful relationships.

Second, it differs from the Cyberball experience in the temporal nature of the social rejection. The exclusion in Cyberball is acute and immediate but very brief in duration (a few minutes at most). In contrast, the social rejection in the Future Life manipulation is not currently experienced but rather as an anticipated state of rejection that may very well evoke a sense of impending doom. Additionally, the rejection forecast is long-term. In fact, the specific feedback provided details a drawn-out process of rejection, losing friends and marriages over many years (see *Experimental Manipulations* section for exact wording). Importantly, people are not particularly adept at affective forecasting (anticipating their future feelings; Wilson & Gilbert, 2005) and are much better at reporting their current emotional state. Research shows a systematic tendency to overestimate the extent and duration of future emotions (Wilson & Gilbert, 2005), which might suggest that people may be more emotionally impacted by anticipating future rejection rather than experiencing it acutely. Similarly, it is important to consider that at the point of measurement following the experience of social exclusion in Cyberball, the experience has already concluded, whereas at the point of measurement following receipt of rejection feedback in the Future Life paradigm, the rejection experience is still to come, and is proverbially "hanging over their head", which could also explain why it is experienced as more severe.

Finally, examining the difference between Cyberball and Future Life experiences of social rejection raises the possibility that the source of rejection may matter considerably. Some previous research has indicated systematic differences in responses to rejection perpetrated by different types of social connections, and, specifically, that

rejection is experienced more strongly if it is levied by someone with whom an individual feels emotionally close (Hawkes, 2011; Jones & Barnett, 2022; Nadzan, 2022). For the Cyberball paradigm, respondents are generally led to believe that they *might* know the other players (e.g., they are also students at the same university); in addition to creating a cover story to hide the truth that the other players are simply computer-programmed confederates, this deception may serve to prime some general sense of affiliation or relational connection. On the other hand, in the Future Life paradigm, the forecast invokes multiple sources high in relational closeness (e.g., friends and spouses), which may also add to the intensity of the injury. However, the immediate source of the prediction itself is made to appear to be results from ones' own personality test responses, raising questions about whether the perception that the rejection feedback could somehow be more "credible" (e.g., because it is objective "scoring" rather than subjective opinions of others) may also be a relevant factor.

Of course, aside from the features of rejection experiences brought to light by these relatively rare side-by-side comparisons of rejection experiences, there are many other dimensions by which rejection experiences can differ. For example, social rejection can occur in relatively private settings (e.g., receiving rejection in a dyadic setting in person, by phone call, text message, or email) or it can be public and broadly witnessed (e.g., by classmates, coworkers, or members of the general public). Research on humiliation has indicated that being the recipient of negative social evaluations is often experienced as "embarrassing" and "shameful", especially if it occurs in the presence of

others (Torres & Bergner, 2010), which is one reason why public humiliation is often used as a punishment (Kádár & Ning, 2019; Torres & Bergner, 2012).

Kerr and Levine (2008) also detail other types of social rejection, such as those that involve failing to follow social norms of politeness, such as invading someone's personal space without permission, interrupting or cutting off speech, or refraining from typical social greetings; exploiting others (e.g., not reciprocating or sharing; taking advantage; being insincere or deceptive); slandering; disengaged behavior (e.g., yawning, seeming bored, failing to make eye-contact); and undermining others' group membership by differentiating them from the group (e.g., "othering"; Thomas-Olalde & Velho, 2011). The dozens of examples provided in their descriptions (and those drawn from other sources) speak to the staggering number of ways in which humans inflict social rejection on other humans. The differences in behaviors, settings, sources, motivations, frequency, duration, and other features that these diverse rejection experiences may entail certainly help to explain why responses to rejection experiences can vary – sometimes dramatically – in nature, intensity, duration, and subjective experiences.

Given that the most theoretically and empirically sound account how situational factors impact responses to social rejection (so far) has been presented by Bernstein and Claypool (2012a, 2012b), the current study follows this line of inquiry, investigating responses to the same two manipulations of social rejection and expecting responses consistent with their explanation of differences in rejection severity and underlying social pain responses.

Hypothesis 2a: Social rejection through Cyberball will be associated with increased negative emotional state, whereas rejection through the Future Life paradigm will be associated with flattened emotional responses.

Hypothesis 2b: Social rejection through Cyberball will be associated with a greater reduction in self-reported needs satisfaction relative to rejection through the Future Life paradigm.

Hypothesis 3a: Social rejection through Cyberball is expected to elicit prosocial behavior, as evidence of motivation for social reconnection.

Hypothesis 3b: Social rejection through the Future Life paradigm is expected to elicit antisocial behavior, as evidence of motivation for retaliation.

Responses to Social Acceptance

Consistent with the positive benefits of social connection, belonging, and group membership from an evolutionary, societal, and developmental perspective, people experience social acceptance very positively. The evolutionary impetus for social connection and belonging to feel rewarding is clear, and the mechanisms through which people experience these rewards are pervasive. Social acceptance is associated with strong positive emotions (Baumeister & Leary, 2017; DeWall & Bushman, 2011). In fact, the idea that positive social interactions are "heartwarming" is really a literal description: people actually feel "warm" when they experience positive social connection (Barg & Shalev, 2012; Inagaki, 2014; Zhong & Leonardelli, 2008). Physiologically, experiences of social acceptance are associated with multiple social reward systems, including those involving oxytocin (Feldman, 2012; Fineberg & Ross, 2017; Keeler et al., 2015; Norman

et al., 2012; Pearce, Woldarski, Machin, & Dunbar, 2017), dopamine (Lin, Chen, Yeh, & Yang, 2011; Pearce et al., 2017; Skuse & Gallaher, 2009), and opioid systems (Inagaki, 2014; Inagaki et al., 2016).

Even recalling past instance of positive social interactions can be rewarding and trigger feelings of connection and belonging (Ross & Inagaki, 2023) and priming such thoughts can help to reduce the likelihood of aggression following social rejection, presumably due to the mitigation of the threat to belongingness (Twenge et al., 2007). The powerful effects of social acceptance help to explain why positive social relationships, such as secure attachments with parents (Fang et al., 2014; Liddell & Courtney, 2018; McLachlan et al., 2010) and high-quality friendships (Masten et al., 2012; McLachlan et al., 2010; Tang et al., 2022), which are ostensibly rich in experiences of acceptance, may help to buffer against the deleterious effects of social rejection.

It should be noted that very few studies have compared different types of social acceptance experiences to understand whether there are characteristics of these experiences that lead to different emotional or physiological effects. The only systematic comparison that could be located were Bernstein and Claypool's (2012a, 2012b) comparison of acceptance in the Cyberball and Future Life manipulations. As might be expected, in one study, participants did report more positive perceptions of acceptance in the Future Life paradigm, which involves receiving positive feedback about one's future relationships – specifically that they will be positive, plentiful, and fulfilling – compared to acceptance in the Cyberball paradigm, which merely consists of continued participation in the ball-toss game (Bernstein & Claypool, 2012a; see *Experimental*

Methods section in this paper). Notably, acceptance in the Future Life paradigm involves explicit positive feedback and direct positive statements about ones' relational value, whereas the perception of feeling accepted in the Cyberball game may be more ambiguous. Similarly in addition to fulfilling needs for belonging, the prediction of future acceptance and belonging in the Future Life manipulation is likely to boost other needs, including self-esteem, control, and meaningful existence, whereas the connection to these needs is tenuous at best for Cyberball acceptance.

Although the responses to Future Life acceptance were marginally more positive (e.g., higher self-reported positive affect and higher needs satisfaction) than for the Cyberball acceptance across the other experiments detailed by Bernstein and Claypool (2012a, 2012b), these differences typically failed to reach statistical significance. However, given the small samples sizes in these experiments (16-54 participants; Bernstein and Claypool, 2012a, 2012b), it is possible that there simply wasn't enough statistical power to detect a meaningful difference. Additionally, Bernstein and Claypool (2012a) assess the basic needs satisfaction only as a composite, thus obscuring potential significant differences in one or more specific subscales. Although often overlapping (Gerber, Chang, & Reimel, 2017, these dimensions can operate in distinct ways (Abrams et al., 2011; Lutz, & Schneider, 2021; Williams, 2009). With larger sample sizes and the ability to disentangle specific needs in analysis, it is expected that in the current study, there will be a significance difference in acceptance experiences.

Hypothesis 2c: Social acceptance through the Future Life paradigm will be associated with greater increases in positive emotional state relative to social acceptance through the Cyberball paradigm.

Hypothesis 2d: Social acceptance through the Future Life paradigm will be associated with greater increases in self-reported needs satisfaction relative to social acceptance through the Cyberball paradigm.

Hypothesis 3c: Social acceptance through either paradigm is expected to elicit prosocial behavior.

Current Study

Given the overwhelming evidence of the evolutionary and developmental relevance of social rejection, and its implications for public health (Bhatti & ul Haq, 2017; Holt-Lunstad et al., 2015; Pantell et al., 2013) and safety (Böckler et al., 2010; Sapru, 2019), understanding how people respond to experiences of rejection is fundamentally interesting as an exploration of human nature, but is also a matter of practical importance. Yet, the apparent inconsistency in affective and behavioral responses and resulting debates about the underlying mechanisms of these responses hamper the ability to intervene to reduce long-term personal, interpersonal, or societal damage caused by social rejection. Researchers continue to struggle for a coherent explanation of responses to social rejection and addressing experiences with rejection in daily life is just as complex and confusing. With so many potential manifestations and response pathways, social rejection is a beast with many heads that is difficult to grapple with.

The current study seeks to extend the scientific understanding of responses to social rejection by further illuminating the differential effects of distinct types of rejection experiences. Although there is indication that features of rejection experiences (source, duration, motive, mode, etc.) are relevant to how individuals respond, studies involving direct comparisons are rare (Bernstein and Claypool, 2012a, 2012b; Lutz & Schneider, 2021; Molden et al., 2009) and each have only included a very limited set of response metrics, and none has included measurement of salivary cortisol or provided an opportunity to assess immediate effects on social interaction opportunities. As such, this is the first study, to date, to systematically compare physiological stress responses (cortisol), affect responses, basic needs satisfaction (belonging, self-esteem, control, and meaningful existence), and behavioral responses (prosocial vs. antisocial) to two different types of social rejection. This research is needed to build cohesion from previous work.

In addition to advantages in experimental consistency, examining multiple elements of the response to social rejection within a single experiment affords the opportunity to measure and account for the relationships among the physiological, subjective, and behavioral reactions. This study is also novel in providing an opportunity to simultaneously examine differential responses to varied types of social acceptance experiences using this same comprehensive set of response indicators; as noted, systematic investigations of social acceptance experiences have been conspicuously missing in the literature.

To build on previous findings, this study specifically employed the Cyberball and Future Life paradigms that are compared in Bernstein and Claypool's (2012a, 2012b)

studies. Because the researchers have already established a link to injury severity and pain overlap theory, the current study provides an additive contribution by exploring dimensions of the social rejection response not measured in these studies, including cortisol, basic needs satisfaction (i.e., separating out the four subscales), and behavioral responses. Furthermore, the current study acknowledges and explores the potential for individual differences in response to one or both types of rejection experiences by analyzing the effect of dispositional levels of fear of negative social evaluation, a personality trait related to rejection sensitivity and physiological differences in the response to social rejection (Kortink et al., 2018).

Summary of Hypotheses

Consistent with pain overlap theory and prior evidence (Bernstein & Claypool, 2012a, 2012b), it is expected that respondents who are rejected, regardless of the experience will exhibit a pattern of physiological, subjective, and behavioral responses consistent with a social pain response, but that the nature of that response will vary as a function of the rejection experience. While an increase in salivary cortisol is expected for both groups, those who experience rejection in the Cyberball manipulation (i.e., being left out; a milder social injury, Bernstein & Claypool, 2012a, 2012b) are expected to exhibit increased negative emotional state, reduced needs satisfaction, and a tendency towards prosocial behavior, whereas those who experience rejection in the Future Life manipulation (i.e., forecasted a future of being rejected; a more severe social injury, Bernstein & Claypool, 2012a, 2012b) are expected to exhibit flattened affect

characteristic of emotional analgesia, a smaller reduction in basic needs satisfaction[9], and evidence of antisocial (hostile) behavior.

Based on evidence of the positive effects of social acceptance, both types of acceptance experiences are expected to elicit increased positive mood, increased needs satisfaction, and evidence of prosocial behavior, but no change in cortisol. However, the boost in positive mood and basic needs satisfaction is expected to be greater among participants who experience acceptance in Future Life (forecasted a future of acceptance and belonging) compared to participants who experience acceptance in Cyberball (continually included in the game).

Specifically, the following four set of hypotheses will be tested. See Figure 1 for an overview of hypotheses by experimental condition.

Hypothesis 1: Main Effects of Social Rejection Versus Acceptance.

Comparing between social rejection and social acceptance, aggregating across the manipulation type (Cyberball and Future Life), those who experience rejection are expected to evidence increases in cortisol (*Hypothesis 1a*), less positive affect (*Hypothesis 1b*), and reduced needs satisfaction (*Hypothesis 1c*), relative to participants who experience social acceptance. There is no directional hypothesis for behavioral response differences overall.

[9] Note that this reduction in basic needs satisfaction is consistent with affective flattening; due to the wording of the survey items and number of positively versus negatively coded items, a decline in both positive and negative needs states characteristic of a "numbing" response would still correspond to decreased scores on at least some dimensions of the basic needs measure relative to baseline.

Hypothesis 2: Differences Between Manipulation Types. Distinct social pain pathways are expected to emerge for rejection experiences, with increased negative emotional state ((*Hypothesis 2a*) and greater reduction in basic needs satisfaction ((*Hypothesis 2b*), among those who are excluded in Cyberball, and evidence of flattened affect (*Hypothesis 2a*) and needs (*Hypothesis 2b*) among those forecasted a future of rejection in Future Life paradigm. Stronger positive responses in affect (*Hypothesis 2c*) and needs (*Hypothesis 2d*) are expected for those forecasted a future of belonging and acceptance in Future Life compared to those included in Cyberball.

Hypothesis 3: Behavioral Responses. Consistent with prior evidence of responses to be ignored versus being overtly rejected (Bernstein & Claypool, 2012a, 2012b; Lutz & Schneider, 2021; Molden et al., 2009), participants who are left out in the Cyberball manipulation are expected to exhibit prosocial behavior (*Hypothesis 3a*), whereas those who are forecasted a future of rejection in Future Life are expected to exhibit antisocial or hostile responses (*Hypothesis 3b*). Participants who experience acceptance in either manipulation type are expected to provide prosocial responses (*Hypothesis 3c*).

Hypothesis 4: Interrelated Processes. Consistent with the interrelated functions of physiological, emotional, and behavioral processes, it is expected that cortisol responses, affect responses, needs satisfaction, and behavioral responses to social rejection will be interrelated.

Hypothesis 5: Individual Differences. Consistent with prolific evidence of individual differences in detection of and responses to rejection experiences, it is expected that there will be individual-level variability in cortisol ((*Hypothesis 5a*), affect (*Hypothesis 5b*), needs satisfaction ((*Hypothesis 5c*), and behavioral responses to rejection (*Hypothesis 5d*). It is also expected that those who report higher levels of fear of negative social evaluation will display greater responses to social rejection in cortisol (*Hypothesis 5e*), affect (*Hypothesis 5f*), and need satisfaction (*Hypothesis 5g*) compared to those who report lower levels of fear of negative social evaluation.

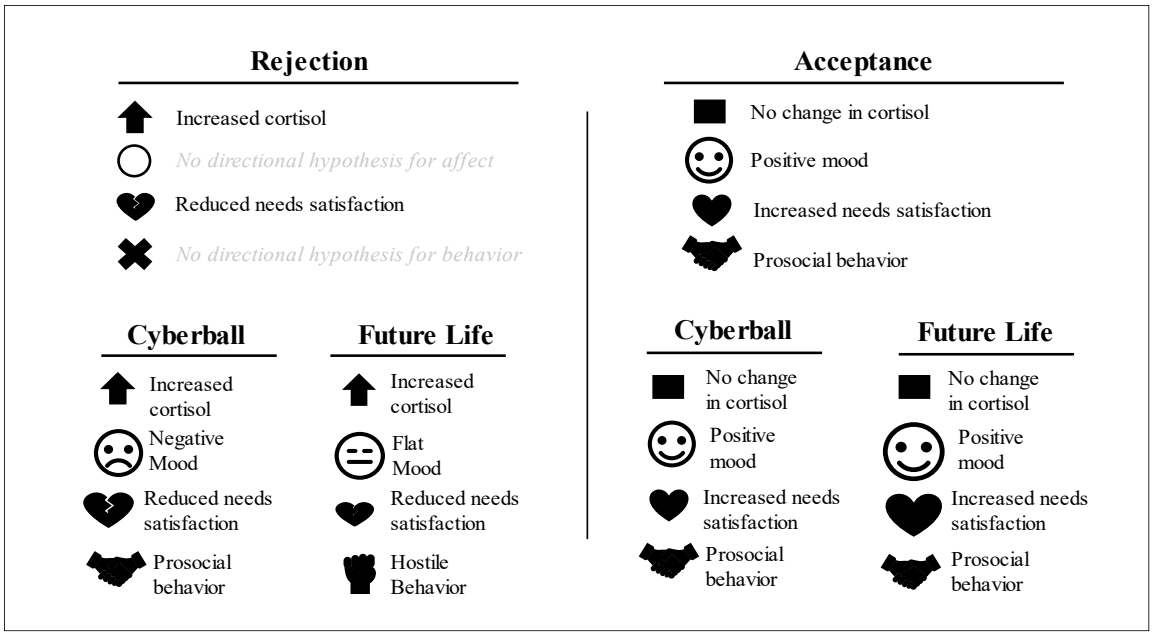

Figure 1. Hypotheses by Experimental Condition.

Methods

Participants

Participants were 127 students enrolled (ether full or part time) at a large state university in the midwestern United States. This study was part of the university's ongoing research system portal for the psychology department and was one of several studies being conducted at the time (2015-2018). Students were incentivized to participate in studies through this portal in their psychology classes through required research participation or extra credit, according to professors' class policies. In addition, researchers announced the opening of this particular study to thirteen classes, including classes in introductory psychology and psychological research methods. No monetary or other incentives were provided for participation.

Of those who reported their gender, 79% were female and 21% were male. Participants ranged in age from 17 to 50 years old, averaging 21 to 22 years of age (M = 21.65, SD = 5.10). Respondents who were under the age of majority in the state (19) were required to submit a signed parental consent form prior to participation. Class standing was distributed as followings: 23% freshmen, 18% sophomore, 30% junior, 26% senior, and 3% graduate students. The majority of respondents (68%) identified as White (non-Hispanic). Sixteen percent identified as Hispanic or Latino/Latina, 7% as Black or African American (non-Hispanic), 5% as Asian American, and 4% selected the "other" response.

Data for two respondents was removed due to a computer error that resulted in missing data for those respondents. Additionally, cortisol data was not included for five

participants due to insufficient quantity, storage error, and/or not abiding by prescreening requirements, such as smoking tobacco products right before participation. No respondents declined to consent, withdrew during the study, or asked for their data to be removed after debriefing.

Experimental Manipulations

Acute Social Rejection (Cyberball). Cyberball[10] (version 4.0; Williams, Yeager, Cheung, & Choi, 2012) uses a simulated computer-mediated interaction as a paradigm for ostracism or acceptance. Participants engage in a virtual ball-toss game with two to three other players, whom they are led to believe are other real humans but are actually computer-programmed confederates. Some participants stop receiving turns from the confederates, such that the other players appear to exclude them from the game (rejection condition) while other participants receive balanced turns in the game for its entirety (acceptance condition). To diminish reactivity, the introduction page describes the purpose of the game as a mental visualization experiment and respondents are asked to imagine that they are playing the ball-toss game in-person rather than as a computer game. In the current study, respondents were led to believe that the other players were fellow students at their university who were also taking part in the same research study. Game play lasted for approximately 5 minutes.

Cyberball has been extensively used as a manipulation of ostracism or social rejection and has demonstrated efficacy in triggering social pain responses. In fact, a

[10] The latest version and instructions for use of this open-source software can be found here: https://www.empirisoft.com/cyberball.aspx

meta-analysis of 120 studies using the paradigm found that effect sizes are typically large and effectiveness is relatively impervious to structural variations such as differences in the number of players or ball tosses (see Hartgerink, Van Beest, Wicherts, & Williams, 2015 for a review and meta-analysis). Although the deception that the other players are real humans is a typical feature of the paradigm, participants display social pain responses even when they are told that the other players are just computer simulations (Zadro, Williams, & Richardson, 2004).

Anticipated Social Rejection (Future Life). The second manipulation of social rejection replicated a paradigm developed by Twenge, Baumeister, Tice, and Stucke (2001). To set the stage for this manipulation, participants completed the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975) and received two types of automatically generated feedback about their results. First, they received their extroversion score, alongside a brief interpretation of their score, including whether it was high or low and what high versus low scores indicate about their personality (see Appendix). Importantly, this feedback was consistent with their actual responses on the questionnaire; the web survey software was programming to automatically tally up their responses to the questions representing extroversion and to deliver pre-written feedback based on the range of their true score. The purpose of providing extroversion scores was to expose participants to feedback that has some credibility or face validity, so participants would be more apt to believe the subsequent experimentally manipulated feedback.

Second, participants were given a prognosis for their future social relationships. They were either told that they would have fulfilling relationships in the future (acceptance condition) or that they would end up alone, lacking stable or meaningful relationships[11] (rejection condition; see Appendix for exact wording). Participants were told that the feedback was once again based on their questionnaire responses, this time involving a compilation of their scores on all the personality dimensions measured by the questionnaire. In actuality, the second set of feedback was not generated by the actual questionnaire responses, but instead was randomly assigned to participants.

The efficacy of this manipulation has been demonstrated numerous times as a reliable method of eliciting social pain responses in a laboratory setting, and has been found to be effective even when respondents report that they do not believe or are suspicious of the accuracy of the feedback (e.g., Baumeister, DeWall, Ciarocco & Twenge, 2005; DeWall & Baumeister, 2006; Twenge, Catanese, & Baumeister, 2002; Twenge et al., 2001; Twenge et al., 2007).

Measures

Fear of Negative Social Evaluation. Before participating in any behavioral manipulations, participants completed the Brief Fear of Negative Social Evaluation Scale (Leary, 1983). Respondents are presented with twelve descriptions of personality characteristics or behaviors and asked to rate the degree to which the description is

[11] Note that the feedback for the rejection condition was modified slightly from the original version used in Twenge et al. (2001) and DeWall and Baumeister (2006). Specifically, the onset of changes in social relationships was given as a timeframe in the current study (e.g., “five to seven years”), whereas the original wording referenced more specific ages (e.g., mid-20s). The change was made to better accommodate non-traditional college students.

characteristic of them on a 5-point Likert-type scale, using the following response options: not at all characteristic of me (1), slightly characteristic of me (2), moderately characteristics of me (3), very characteristic of me (4), and extremely characteristic of me (5). Items include the following examples: “I often worry that I will say or do the wrong things” and “I am usually worried about what kind of impression I make”. Responses are coded such that higher scores indicate greater fear of negative social evaluation. The shortened version used in this study has demonstrated a high degree of equivalency to the original (longer) version of the scale (see Leary, 1983). In the current study, internal consistency was excellent (Cronbach’s $\alpha = .94$).

Affect. Affect was measured using the 20-item version of the Positive and Negative Affect Schedule (PANAS; Wastson, Clark, & Tellegen, 1988) at two time points: (1) during the baseline measures prior to any manipulations and (2) following the manipulation of social rejection or acceptance. The PANAS is comprised of 20 mood descriptors, of which 10 represent dimensions of positive affect (e.g., interested, excited, proud) and 10 represent dimensions of negative affect (e.g., distressed, hostile, guilty). In the current study, participants were asked to report how they feel “right now, that is, at the present moment” using a five-point scale with the following response options: very slightly or not at all (1), a little (2), moderately (3), quite a bit (4), and very much (5). Responses are coded such that higher scores represent more of each mood, respectively. Past research has demonstrated that the PANAS demonstrates a high degree of validity and reliability in both clinical and community samples (e.g., Crawford & Henry, 2004; Ostir et al., 2005; Watson et al., 1988) and for a range of age-groups (Huebner & Dew,

1995). In the current study, the internal consistency (Cronbach's alpha) was good at both baseline (positive affect, α = .89; negative affect, α = .75) and post-manipulation measurements (positive affect, α = .91; negative affect, α = .91).

Basic Needs Satisfaction. Satisfaction of the four basic social needs purportedly threatened by social rejection (belonging, self-esteem, meaningful existence, and control) was measured using William's Ostracism Needs Threat Scale (Williams, 2009). This scale is constructed as four subscales corresponding to each of the four basic social needs, each comprised of five indicator items which describe a feeling that is relevant to the social need. For example, the belonging subscale includes items such as "I feel like an outsider" and "I feel rejected"; self-esteem includes "I feel good about myself" and "I feel liked"; Meaningful Existence includes "I feel invisible" and "I feel important" (reverse-scored); and Control includes "I feel powerful" and "I feel that others decide everything" (reverse-scored). Each item is rated on a 5-point Likert-type scale anchored by *"1 – Not al all"* to *"5 – Extremely"*.

Participants responded to this scale twice: first, as a baseline measure before any experimental procedures and, second, after being exposed to the manipulation of social rejection or acceptance. For baseline measurements, participants were asked to indicate the degree to which they are experiencing each of the feelings described *currently*, whereas for the post-manipulation administration, participants were asked to indicate the degree to which they experience each of the feelings *during the manipulation* (i.e., which playing the online game or while reading the feedback from the personality test). For a review of experimental and psychometric evidence using this scale, see Williams (2009).

In the current study, internal consistency for each of the subscales was good at both administrations: Belonging (baseline, α = .68; post-manipulation, α = .89), Self-Esteem (baseline, α = .84; post-manipulation, α = .90), Meaningful Existence (baseline, α = .75; post-manipulation, α = .90), Control (baseline, α = .74; post-manipulation, α = .90).

Behavioral Measure. Participants were provided with an opportunity to demonstrate a positive social orientation or a hostile social orientation using procedures adapted from Twenge et al. (2001). Before the manipulation of social rejection or acceptance, all participants were asked to indicate their opinion on abortion as pro-life or pro-choice and write a brief essay (1-2 paragraphs) describing their perspective[12]. They were then asked to read another essay on the same topic describing the opinion opposite their own and to provide ratings on five indicators of quality (e.g., "This essay is well organized" and "The author used appropriate spelling and grammar") on a 5-point Likert scale using the following response options: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). An open-ended section for "comments" was also provided. Participants were told that this essay had been written by another participant in the same study they were participating in; in reality, the essay was written by researchers prior to the experiment.

After the manipulation of social rejection or acceptance and follow-up measures, all respondents received feedback about their essay showing that they had been given a relatively negative rating on their essay. The feedback was presented as a completed

[12] Note that this is the same topic used by Twenge et al. (2001), and it was selected because it is an issue on which people often have strong personal opinions.

rating scale identical to the scale they had previously filled out to evaluate essay presented to them earlier in the procedures; all ratings were negative or neutral. Negative remarks were also provided in the open-ended comments section (e.g., "one of the worst essays I've read"). Once again, respondents were led to believe that this feedback was provided to them by another study participant (a fellow student at their university) when in actuality the feedback was created by the researchers for use in the experiment. These procedures have previously been found to be perceived as a threat to individuals' ego and self-esteem, to generate negative feelings, and to trigger hostile or aggressive behaviors (e.g., Bushman & Baumeister, 1998; Twenge et al., 2001)[13].

After receiving this feedback, participants were told that some of the students who are participating in this study are applying for research assistant positions for the university's psychology department, so the department is collecting evaluations of all students who participate in their research[14]. The participant was then asked to provide an evaluation for the student who (negatively) rated their essay. The participant was presented with 10 descriptions of relevant characteristics and appraisals: for example, "the applicant is kind," "I would like to participate in a study that was conducted by the applicant", and, finally, "If I were in charge of hiring research assistants, I would hire the

[13] Note that other studies often compared to a neutral or positive feedback condition whereas the current study only included a negative feedback condition. This decision was made because (1) previous studies have already demonstrated the efficacy of this paradigm relative to control conditions and (2) to preserve degrees of freedom and statistic power; since there was already a 2 x 2 factorial experimental design varying the acceptance/rejection condition and type of social pain experience (Cyberball vs. Future Life) adding another factor (positive vs. negative feedback to the essay) would have required much greater sample sizes that the current study and this was felt to be impractical for the current experiment.

[14] Note that in Twenge et al. (2001) participants were told that the specific student who rated their essay had applied for an assistant position; the current study changed this wording slightly to be more general (many participants may be applying). This was done because researchers felt that this might be more believable given the university's procedures.

applicant." Each description was rated on a 10-point scale ranging from *strongly disagree* to *strongly agree*. Responses were coded such that higher scores reflected more positive evaluations. Positive evaluations were interpreted to represent a positive social orientation and a desire to seek social connection, while negative (or less positive) evaluations were interpreted as a hostile social orientation and a desire for retaliation against the student who had (ostensibly) critiqued them, their work, or their opinions. The measure demonstrated excellent internal consistency ($\alpha = .94$).

Cortisol Assays. Each respondent provided five saliva samples through passive drool saliva collection procedures: (1) baseline measure before any experimental manipulations), (2) immediately following the manipulation of acceptance/rejection, (3) 10-15 minutes post manipulation, (4) immediately following the receipt of negative feedback about their essay, and (5) approximately 10 minutes post receipt of the negative feedback. Due to the latency of the cortisol response, only the baseline (1) and samples collected on delay from the stress-inducing experimental procedures (3 & 5) were used for this research[15].

Salivary cortisol levels were assessed with Salimetrics high sensitivity salivary cortisol immunoassay kit, following the saliva collection and handling advice supplied. This salivary cortisol assay is highly correlated with cortisol serum assessments ($r = .91$) and sensitive to a minimum concentration of less than 0.003 μg/dL. Consistent with the recommendations of Salimetrics' sample collection advice, participants were asked not to

[15] Note that the unused samples (2 & 4) were collected immediately following stress-invoking study activities for analysis of alpha-amylase or alternative physiological stress markers which is not included in the current research.

eat within sixty minutes of the study, not to drink dairy or caffeine within twenty minutes of the study, not to drink alcohol within twelve hours of the study, and not to brush their teeth within forty-five minutes of the study. These instructions were included in the description of the study on the online subject pool and were also emailed to each participant approximately twenty-four hours before their study timeslot, through the online subject pool. All samples were taken between 12pm and 6pm to control for diurnal fluctuations in cortisol concentration.

Procedures

Prior to signing up for the study through the university's online participation portal, respondents were required to complete a short screening questionnaire, which was conducted as a web survey. The screening questionnaire was designed to identify participants who may be at elevated risk of negative responses to study procedures. Respondents who indicated a current or past mental health disorder or who had experienced a significant trauma or major stressor were not invited to participate in the remaining study procedures; this was a requirement requested by the university's Institutional Review Board (IRB) to protect students' wellbeing and safety.

At the end of the screening questionnaire, qualifying respondents were provided with instructions for preparing for the laboratory study. These instructions included restrictions on smoking, eating, and drinking caffeine prior to participation as quality control for cortisol assays. These instructions were also emailed to respondents via the participation portal the day before their scheduled participation. The study was described as involving research related to personality and social behavior, which would involve

providing saliva samples for hormone assays, completing online surveys, and participating in online interactions with other students. This description, and the use of the deception in describing the study, was approved by the IRB.

At the beginning of the laboratory study, which was hosted in a research lab in the university's psychology department, the researcher greeted respondents in front of the laboratory and apologized for being delayed (2-3 minutes past the start of the study) while getting another participant set up. The researcher then led respondents from a waiting area past several closed doors in the same wing of the department on their way to the laboratory room; each of these rooms was also labeled with the name of the same study the participant had signed up for. This was done intentionally to suggest that other students may be participating in the same study simultaneously.

Once inside the laboratory room, participants were read a full consent statement. They were also given a copy to read to themselves and to keep if they wished. Similar to the description provided on the participation portal, the consent form explained the research as a study about personality and social behavior and described the study session as involving the following activities: providing saliva samples for hormone assays, completing online surveys, and participating in online interactions with other students. Participants were advised that participation was completely voluntary and that they could withdraw from the study at any time or request for their data to be removed before analysis if they chose. All participants were required to provide written consent to continue with the experiment. Participants were also asked to verbally indicate whether they had eaten, had a caffeinated drink, smoked, or engaged in another activity that might

affect their hormone levels. Participants who admitted to one or more of these activities were not excluded from participation, but researchers kept notes and later determined whether or not to pull their saliva samples prior to analysis.

After consenting, respondents were asked to enter the web survey portal. The researcher entered a participant ID, which randomly assigned the participant to one of the two paradigms of social rejection (Cyberball or Future Life). Participants then completed a short set of questions asking for demographic information, the brief fear of negative social evaluation scale, and baseline measures of affect and basic needs satisfaction. After completing these measures, the participants were presented with a screen that asked them to stop and wait for further instructions. When the researcher returned, he or she apologized if the participant had been waiting, again giving the excuse that they were with other study participants. Participants were asked to provide a baseline saliva sample, then they were instructed to continue with the web survey portal until they research another screen asking them to stop.

During the next survey module, participants completed activities designed to set up the context for the behavioral measure. First, they were asked to indicate whether they would characterize their views on abortion as pro-life or pro-choice, and then to write a brief essay (1-2 paragraphs) about their views. The researcher then returned to explain that they had been matched with another study participant and would be evaluating each other's essays. The researcher appeared to check the computer to see if the essay from the other participant had been loaded. After confirming that it had, the participant was asked to proceed in the web module.

The next screen presented an essay, ostensibly written by the other participant, about their views on abortion. Every participant was assigned to read and evaluate an essay that gave the opposite opinion they had provided (i.e., participants who said they were pro-life were presented with an essay that described a pro-choice perspective). Participants were then asked to evaluate the essay (see description in *Measures* above). Respondents were told that their own essays were being loaded into the system and assigned to another participant to read.

The next module consisted of the social rejection paradigms. Based on random assignment, participants either opened a link to the online Cyberball game or completed the Eysenck Personality Questionnaire, in accordance with the procedures for each manipulation (see *Experimental Manipulations*). As described, respondents were randomly assigned to experience acceptance or rejection within each of these paradigms. All participants completed the measures of affect and basic needs satisfaction immediately following the rejection/acceptance experience and were asked to provide another saliva sample for cortisol analysis approximately 10-15 minutes after its conclusion.

Participants were then told that they had received the feedback for the essay they had written earlier in the study; as described, all participants were provided with negative feedback, (purportedly from another study participant) that was designed to trigger aggressive responses. After reading the feedback, participants were asked to provide an evaluation of the individual for consideration during hiring for research assistant positions in the psychology department. After rating that individual on the 10-item

evaluation questionnaire, all participants were asked to provide a final saliva sample for cortisol analysis.

At the conclusion of these study procedures (approximately 60-90 minutes in duration), all participants were thoroughly debriefed. Researchers carefully described the true purpose of the research and all of the instances in which deception had been used. The researcher apologized for the use of deception and ensured that the participants understood the truth through verbal comprehension checks. Participants were also given a packet of information that provided resources (counseling services at the school and anonymous hotlines) in case they experienced negative feelings after the experiment. During debriefing, respondents were asked questions about the believability of the manipulations[16] and were given the option to withdraw their data from the study if they chose to, with no penalty. Figure 2 below diagrams the laboratory procedures.

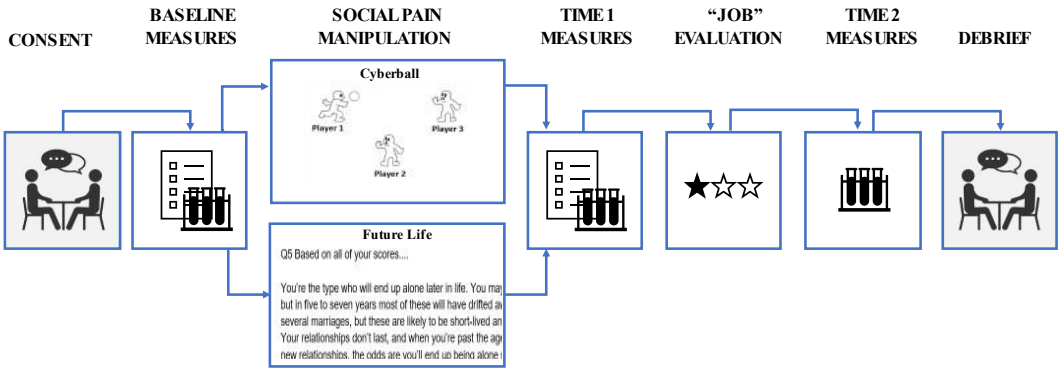

Figure 2. Research Procedures

[16] This qualitative feedback indicated that there were some respondents who claimed to have been suspicious of the manipulations, but most respondents believed at least some elements of the deception.

Statistical Analysis

Data Configuration. To create a comprehensive dataset for analysis, four sources of data were cleaned and merged. Because of the differences in study procedures, two versions of the web survey were created: one designed for participants in the Cyberball manipulation and one designed for participants in the Future Life manipulation. Each version was cleaned by removing test data and data from respondents who could not complete the experimental procedures due to technical problems with study software, as well as verifying the coding and responses in each data field. These web survey files were merged together and then merged with meta data which provided the paradigm (Cyberball or Future Life) and condition (acceptance or rejection) associated with each participant's unique identifier number which was generated during random assignment procedures. Finally, cortisol assay data (analyzed as described above) was also merged with the web survey and meta data based on these unique identifier numbers[17].

The following composite scales were created for use in descriptive analyses:

1. ***Positive affect*:** for each the pre-manipulation and the post-manipulation measure of affect, respectively, responses were averaged across the 10 descriptors of positive emotions.
2. ***Negative affect*:** for each the pre-manipulation and the post-manipulation measure of affect, respectively, responses were averaged across the 10 descriptors of negative emotions.

[17] All samples were labeled with the unique identify number.

3. ***Fear of Negative Social Evaluation*:** before creating an aggregate measure, four of the 12 items were recoded to be consistent with the interpretation that a higher score equates to a higher degree of fear of negative social evaluation. After reverse coding these items, an average of responses on the full set of items was computed.
4. ***Basic Needs Satisfaction*:** for each scale and administration, items were recoded such that a higher score reflected positive levels of belonging (three items reverse coded), self-esteem (one item reverse coded), meaningful existence (three items reverse coded), and control (two items reverse coded). Then, for both the pre- and post-manipulation administrations, respectively, a mean score was created for each of the four subscales (belonging, self-esteem, meaningful existence, and control) separately.
5. ***Research Assistant Job Evaluation*:** a mean score of responses on the 10 items was computed.

Descriptive Statistics[18]. Analysis began with a full analysis of the scale statistics (e.g., frequencies, means and standard deviations, as appropriate) for all measures included in this research. Pearson's *r* correlations were assessed among all study variables. For measures of positive and negative affect and each of the four dimensions of basic needs satisfaction (belonging, self-esteem, meaningful existence, and control), paired-samples T-tests were performed to assess evidence of change from baseline to

[18] Note that the following descriptive analyses have already been completed to accurately describe the research methodology: descriptive analysis of the participant characteristics and analysis of Cronbach's alpha for internal consistency of survey measures.

post-manipulation measurements. These T-tests were also performed separately by condition and condition by manipulation. For cortisol, measured at three timepoints, repeated measures GLM (general linear models) were conducted to assess change over time in cortisol levels, with condition and manipulation included as between-subjects factors.

For all self-report scales and measures of cortisol, independent-samples T-tests were performed to assess the presence of differences by gender (men versus women), age (25 or under versus 26 or older[19]), and race/ethnicity (White versus non-White[20]), respectively. Additionally, for measures of affect and basic needs satisfaction, paired-samples T-tests were performed separated by gender, age, and race/ethnicity, respectively.

Hierarchical regressions were performed to assess the relationship between behavioral responses and patterns of change-over-time in cortisol, affect, and basic needs, respectively. In each regression model, the behavioral outcome (job evaluation) was the dependent variable. For each measure of affect (positive and negative affect, separately) and each needs satisfaction scale (again, separately) the baseline measure was added to the model in the first block and the post-manipulation measure was added in the second block. The significance and magnitude of the change in *R* square statistic was evaluated for the second block to assess whether there was a significant and meaningful effect on

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[19] Age was grouped as '25 and under' versus '26 and older' to understand developmental differences between traditional "emerging adults" and older participants. Although some contemporary conceptualizations of emerging adulthood span 18-29 rather than the original 18-25, separating participants using 29 as the age-break would have resulted in a group too small for analysis; even using the current conceptual age break, only 14 participants were 26 or older.

[20] Combining non-White respondents (n = 36) was necessary due to sample size limitations; attempting to separate Black/African American, Hispanic, or other groups would have resulted in groups too small for analysis.

the behavioral outcome above and beyond the initial (baseline) measurement. For cortisol, the same approach was used, but with a total of three blocks due to there being three measurement periods for cortisol: the baseline measure (Sample 1) was added in the first block, the post-manipulation (Sample 2) measure was added to the second block, and the final (Sample 3) measure was added to the third block.

Hypothesis Testing. Hypothesis testing was conducted in a phased approach. The ideal analytic strategy was determined to be a multilevel structural equation modeling (SEM) approach. The benefits of this approach include simultaneous estimation of parameters to account for complex relationships among variables, including analysis of change over time; automatic adjustment for simultaneous estimation of multiple significance tests; and the use of latent factors to minimize measurement error in constructs (Kline, 2023). Therefore, analyses first proceeded with the building of a comprehensive multilevel SEM model to test all hypotheses within a single model of increasing complexity, using a model comparison approach. For these analyses, Mplus statistical software (version 8; Muthén & Muthén, 2009) was used.

Data preparation. As noted, a benefit of using SEM techniques is that modeling latent factors minimizes measurement error relative to the use of composite scores. However, due to the number of latent factors and their associated indicator items, it was not possible to model all constructs as latent factors. Therefore, preparation for hypothesis testing involved creating more parsimonious latent factors to represent each construct. Ultimately, it was not feasible to create a latent factor for either positive or negative affect with acceptable fit statistics or reliability when reducing the number of

indicator items, so composite scores were used in hypothesis testing for both affect scales. Likewise, it was also not possible to include latent factors for basic needs satisfaction measures in the Level 1 model (described below), so composite measures were used for those scales as well. However, latent factors were created for both fear of negative social evaluation and the job evaluation measure.

For fear of negative social evaluation, the twelve total items were reduced to a latent factor modeled by the four best indicators, in the interest of model parsimony (see items below). The resulting factor was reliable ($\omega = .93$), with all factor loadings positive and significant (> .77), and the model was a good fit to the data, $\chi^2_{(2)} = 3.80$, $p > .05$, CFI = 1.00, RMSEA = .09, SRMR = .02.

Table 1. Parsimonious Latent Factor for Fear of Negative Social Evaluation: Indicator Items

1. I am frequently afraid of other people noticing my shortcomings.
2. I am afraid others will not approve of me.
3. I am afraid that people will find fault in me.
4. When I am talking to someone, I worry about what they may be thinking about me.

Similarly, for the job evaluation measure, the ten items were reduced to a latent factor modeled by the four best indicators, in the interest of model parsimony (see items below). The resulting factor was reliable ($\omega = .88$), with all of the factor loadings positive and significant (> .73), and the model was a good fit to the data, $\chi^2_{(2)} = 3.67$, $p > .05$, CFI = 1.00, RMSEA = .08, SRMR = .02.

Table 2. Parsimonious Latent Factor for Job Evaluation Measure: Indicator Items

5. The applicant is friendly.
6. The applicant is kind.
7. The applicant would treat research participants with dignity and respect.
8. If I were in charge of hiring research assistants, I would hire the applicant.

SEM Model. The full SEM model is constructed as a two-level model, with within-subjects effects added at Level 1 and between-subjects effects added at Level 2. Both levels are built as a series of steps, described below; each step involves adding additional effects to the model and evaluating fit statistics (i.e., the sample-size adjusted Bayesian Information Criteria; ssBIC) for improvement to the model (See Figure 3 for the Final Conceptual Model).

Model 0: Unconditional Model. To start, the unconditional model will include only cortisol, affect, and basic needs satisfaction scales and will be used to assess within-subject and between-subject variability.

Model 1: Change Over Time at Level 1. The first stage consists of modeling change over time in cortisol, affect, and basic needs satisfaction scales by adding contrast codes to the model. For affect and basic needs satisfaction scales, measured at baseline and post-manipulation, a single contrast code will be modeled, comparing these two measurements. For cortisol, measured at baseline (Sample 1), post-manipulation (Sample 2), and at the end of the study (Sample 3), two contrast codes are needed to represent change over time. The two orthogonal contrast codes compare (1) baseline cortisol versus the other two measures (Sample 1 versus Samples 2 and 3) and (2) post-manipulation

versus final cortisol levels (Sample 2 versus Sample 3). The covariances among cortisol, affect, and basic needs satisfaction scales are also included in the Level 1 model as appropriate.

Model 2: Covariates at Level 2. Age, gender, and race/ethnicity are added to the model next as covariates, to control for any differences in effects as a function of these demographic factors.

Model 3: Effect Acceptance vs. Rejection Condition at Level 2. Next, the effect of social acceptance versus rejection is modeled on change-over-time in cortisol, affect, and basic needs satisfaction scales, respectively. This model is the first test of Hypothesis 1 (main effects of social rejection versus acceptance) as well as partial evaluation of Hypothesis 4 (the interrelation of processes). In addition, variability in levels of change over time for each measure are assessed separately for acceptance and rejection conditions, in partial evaluation of Hypothesis 5, regarding individual differences in responses to rejection.

Model 4: Manipulation Type at Level 2. Next, the manipulation type (Cyberball or Future Life) is added as a moderator of the effects of rejection versus acceptance on cortisol, affect, and the basic needs satisfaction scales, to test whether there are differences in the effects of rejection and acceptance based on the type of experience, as per Hypothesis 2.

Model 5: Behavioral Expression at Level 2. Then, the effects of (1) acceptance versus rejection condition and (2) manipulation type are modeled as predictors of the

behavioral outcome “job evaluation” (latent factor), to test Hypothesis 3. The effects of change-over-time in cortisol, affect, and basic needs on the behavioral outcome are modeled in conjunction. Further evidence for Hypothesis 4, the interrelation of processes, is assessed.

Model 6: Fear of Negative Social Evaluation at Level 2. Lastly, the latent factor for fear of negative social evaluation is modeled as a modifier of the effects of condition, manipulation type, and effects on the behavioral outcome (job evaluation ratings) as an additional evaluation of Hypothesis 5.

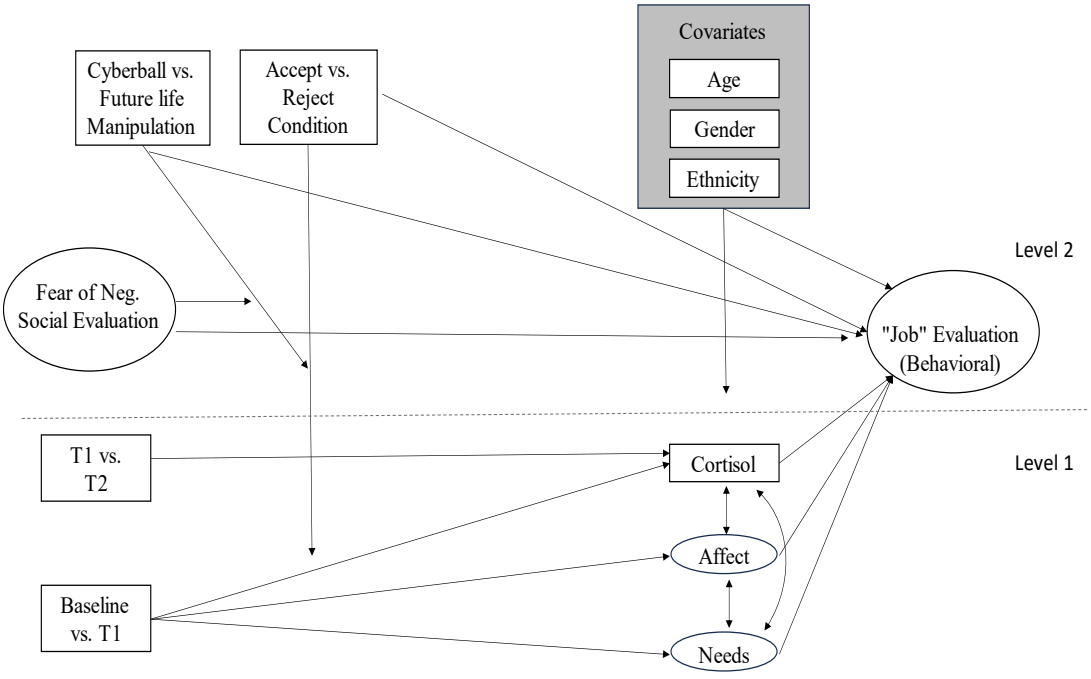


Figure 3. Final Conceptual Model for Hypothesis Testing

Follow-Up Analyses. Due to difficulties encountered in constructing the full multilevel SEM, follow-up analyses were performed to complete evaluation of the study hypotheses. First, a series of repeated-measures GLM analyses were performed to assess

how within-subjects changes in affect, basic needs satisfaction, and cortisol differed as a function of condition (acceptance or rejection), manipulation (Future Life or Cyberball), and fear of negative social evaluation, controlling for demographic factors (age, gender, and race/ethnicity) as covariates. Second, hierarchical regressions were performed to understand the interrelations among cortisol, affect, and needs satisfaction measures; hierarchical regression provides a better method for understanding patterns of interrelation than do correlations due the ability to control for baseline levels of these constructs when analyzing post-manipulation associations.

Results

Descriptive Statistics

Scale characteristics for the full sample and experimental condition are presented in Appendix B. Higher levels of skewness and kurtosis were noted for measures of cortisol, particularly the final sample (skewness = 2.08, kurtosis = 5.03), and post-manipulation measurement of negative affect (skewness = 3.08, kurtosis = 14.28). To minimize the potential for biased estimates or standard errors in hypothesis testing, a log transformation was performed on the cortisol values for all samples; these values and all other measures were also standardized (z-score) for hypothesis testing.

Additionally, it was noted that the mean job evaluation rating (M = 4.03) was considerably lower than the midpoint (5.5) on the response scale, which ranged from 1 (strongly disagree) to 10 (strongly agree). The median was also considerably lower (Median = 4.00) than the response scale midpoint. In fact, the frequency distribution indicated that 88% of respondents provided average job evaluation ratings below the

midpoint. Only 12% (n = 15) provided average ratings above the scale midpoint and only 3% provided average ratings above 7 (out of 10; n = 4).

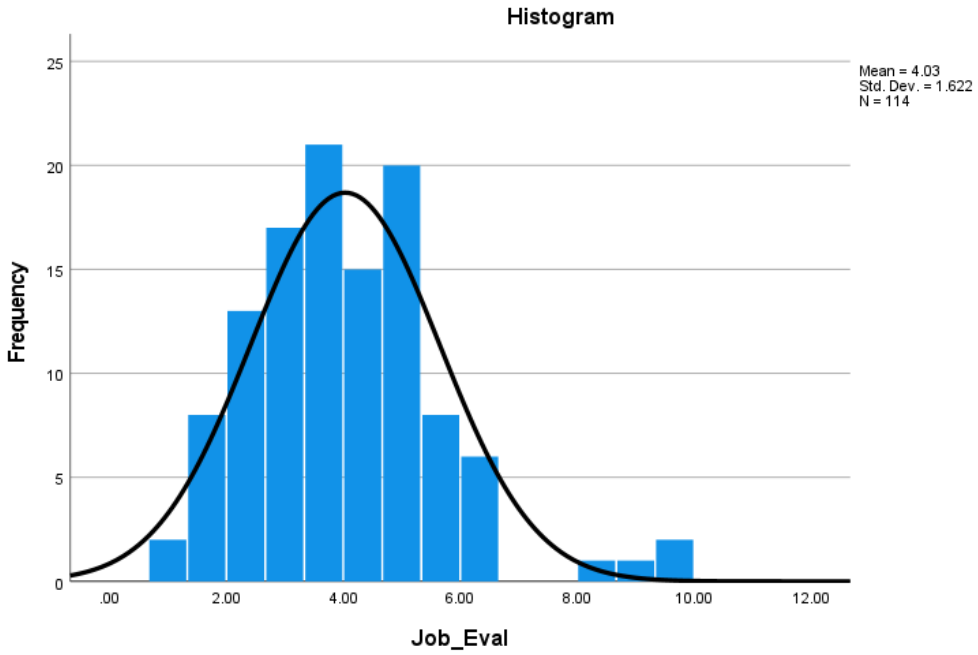


Figure 4. Job Evaluation Ratings, Response Distribution

The "prosocial" responders who provided positive job evaluations (average ratings above the response scale midpoint) were similarly distributed across the Cyberball and Future Life manipulations. There was a slightly higher proportion of prosocial responses among participants who experienced acceptance (15%) compared to rejection (10%) but the difference was not statistically significant based on two-tailed pairwise comparison tests (adjusted for multiple comparisons using the Bonferroni correction).

Table 3. Prosocial Responses by Manipulation

	Cyberball	**Future Life**

	Count	Proportion (Column %)	Count	Proportion (Column %)
Not Prosocial	51	88%	55	87%
Prosocial	7	12%	8	13%

**Note.* Not prosocial = average job evaluation rating below scale midpoint; Prosocial = average job evaluation rating above scale midpoint.

Table 4. Prosocial Responses by Condition

	Accepted		**Rejected**	
	Count	Proportion (Column %)	Count	Proportion (Column %)
Not Prosocial	53	85%	53	90%
Prosocial	9	15%	6	10%

**Note.* Not prosocial = average job evaluation rating below scale midpoint; Prosocial = average job evaluation rating above scale midpoint.

Correlations

Cortisol. For the full sample, baseline cortisol levels showed no significant association with baseline measures of affect or basic needs satisfaction, but those with higher cortisol levels as baseline did have slightly higher levels of positive affect post-manipulation, $r(112) = .19$, $p = .042$. This correlation was significant only for those who were accepted, $r(57) = .30$, $p = .022$, and specifically, only among those accepted in the Cyberball manipulation, $r(26) = .44$, $p = .026$. Baseline cortisol and baseline positive affect were positively associated only for those who were accepted in the Future Life manipulation, $r(31) = .36$, $p = .044$; for these participants (accepted in Future Life manipulation), higher levels of baseline cortisol were associated with lower levels of meaningful existence, $r(31) = -.56$, $p = .001$, and control, $r(31) = -.39$, $p = .032$, post-manipulation. Among participants who were rejected, higher levels of baseline cortisol

were associated with higher levels of perceived belonging post-manipulation, $r(57) = .32$, $p = .017$.

Overall, post-manipulation cortisol levels were associated only with post-manipulation positive affect, $r(112) = .20$, $p = .037$, and this correlation was only significant for those were accepted, $r(26) = .49$, $p = .011$, or rejected, $r(24) = .44$, $p = .031$, in the Cyberball game.

However, there were several associations for final cortisol levels with both affect and needs measures, which differed by condition and manipulation. Overall, respondents who reported higher levels of positive affect post-manipulation, $r(108) = .20$, $p = .036$, or higher levels of negative affect either pre-, $r(113) = .20$, $p = .031$, or post-manipulation, $r(108) = .29$, $p = .002$, exhibited higher levels of cortisol during the final measurement. Lower levels of meaningful existence at baseline, $r(113) = -.27$, $p = .004$ or lower levels self-esteem post-manipulation, $r(112) = -.21$, $p = .025$, were also associated with higher levels of cortisol during the final measurement.

For participants who were accepted in the Cyberball game, higher levels of positive affect, $r(24) = .41$, $p = .045$, and negative affect, $r(24) = .48$, $p = .018$, post-manipulation, were both associated with higher cortisol levels in the final sample, as were lower levels of meaningful existence at baseline, $r(27) = -.46$, $p = .015$. For those accepted in the Future Life manipulation, no correlations for final cortisol levels with affect or needs measures were significant.

For participants who were rejected, higher levels of cortisol at the final measurement were also associated with higher levels of negative affect post-rejection, $r(54) = .35$, $p = .009$, however, this association only reached significance for those who were rejected in the Cyberball manipulation, $r(23) = .50$, $p = .014$. For these participants (rejected in Cyberball), higher levels of cortisol were also exhibited by those who reported higher levels of positive affect post-rejection, $r(23) = .53$, $p = .009$, and those who reported higher levels of control at baseline, $r(25) = .41$, $p = .041$.

Table 5. Correlations with Cortisol Levels, Total Sample

	Cortisol Sample 1	**Cortisol Sample 2**	**Cortisol Sample 3**
Base, Positive Affect	.17	.15	.12
Post, Positive Affect	.19*	.20*	.20*
Base, Negative Affect	.09	-.01	.20*
Post, Negative Affect	.07	.03	.29*
Base, Belonging	.08	.14	-.02
Post, Belonging	.08	-.01	-.17
Base, Self-Esteem	.02	.06	-.16
Post, Self-Esteem	-.03	-.06	-.21*
Base, Meaningful Existence	-.13	-.05	-.27*
Post, Meaningful Existence	.01	-.02	-.08
Base, Control	-.03	.09	-.06
Post, Control	.04	-.01	-.08

Note. Base = baseline measure; Post = post-manipulation measurement. *$p < .05$, **$p < .01$, ***$p < .001$.

Affect. Overall, there were significant concurrent associations for higher levels of baseline positive affect with higher levels of belonging, $r(125) = .28$, $p = .001$, self-esteem, $r(125) = .40$, $p < .001$, and control, $r(125) = .36$, $p < .001$. Among participants who were accepted only, higher positive affect at baseline was also associated with higher levels of belonging post-manipulation, $r(61) = .27$, $p = .036$.

Post-manipulation, higher levels of positive affect were also associated with higher levels of belonging, $r(119) = .19$, $p = .037$, self-esteem, $r(119) = .33$, $p < .001$, meaningful existence, $r(119) = .22$, $p = .017$, and control, $r(119) = .26$, $p = .004$. Post-manipulation positive affect was also higher among participants who had reported higher levels of belonging, $r(119) = .20$, $p = .032$, self-esteem, $r(119) = .30$, $p = .001$, or control, $r(119) = .36$, $p < .001$, at baseline. However, these associations were not consistent across all conditions or manipulations. For example, higher levels of belonging and self-esteem at baseline were associated higher levels of positive affect post-manipulation for participants were accepted ($r(59) = .29$, $p = .026$, and $r(59) = .35$, $p = .006$, respectively), but higher levels of control at baseline were associated with higher levels of positive affect post-manipulation for both accepted, $r(59) = .37$, $p = .003$, and rejected, $r(56) = .33$, $p = .012$, participants.

Among participants who experienced acceptance, higher levels of baseline control were associated with higher post-manipulation positive affect in both the Cyberball, $r(28) = .39$, $p = .039$, and Future Life, $r(31) = .39$, $p = .029$, manipulations, but higher baseline levels of self-esteem were positively associated with post-manipulation positive affective only among those in the Future Life manipulation, $r(31) = .62$, $p < .001$. In contrast,

among participants who experienced rejection, higher levels of control at baseline were associated with higher post-manipulation positive affect only for those in the Cyberball manipulation, $r(25) = .61$, $p = .001$. For participants who experienced rejection in the Future Life manipulation only, higher levels of self-esteem following the manipulation were associated with higher levels of positive affect following the manipulation as well, $r(31) = .47$, $p = .008$.

Overall, higher levels of negative affect at baseline were associated with lower levels of belonging, $r(125) = -.25$, $p = .005$, self-esteem, $r(125) = -.29$, $p = .001$, and control, $r(125) = -.19$, $p = .032$, at baseline. These same concurrent associations were also evident among post-manipulation measurements; in fact, participants with higher levels of negative affect post-manipulation reported lower levels of needs satisfaction across all four needs post-manipulation. Additionally, lower levels of belonging at baseline were associated with higher levels of negative affect post-manipulation, $r(119) = -.22$, $p = .015$.

Among participants who experienced acceptance, lower levels of belonging at baseline were associated with higher levels of post-manipulation negative affect for both the Cyberball, $r(28) = -.49$, $p = .008$, and Future Life manipulations, $r(31) = -.41$, $p = .021$, but the concurrent association between belonging and negative affect, post-manipulation, was only significant among those who experienced acceptance in the Future Life paradigm, $r(31) = -.42$, $p = .019$, and the association of lower levels of self-esteem and meaningful existence at baseline with higher post-manipulation negative

affect were only significant for those experiencing acceptance in Cyberball ($r(28) = -.70$, $p < .001$, and, $r(28) = -.48$, $p = .010$, respectively).

Among participants who experienced rejection, lower levels of belonging post-manipulation were associated with higher levels of negative affect post-manipulation for both Cyberball, $r(25) = -.45$, $p = .024$, and Future Life, $r(31) = -.46$, $p = .010$, but the negative relationship between baseline levels of belonging and post-manipulation negative affect was only significant for those experiencing rejection in the Future Life manipulation, $r(31) = -.38$, $p = .033$. For participants who experienced rejection in Cyberball only, lower levels of self-esteem following rejection were associated with higher levels of negative affect post-rejection, $r(25) = -.53$, $p = .006$. For participants who experienced rejection in Future Life, but not Cyberball, lower levels of meaningful existence during baseline measurements were associated with higher levels of negative affect following the manipulation, $r(31) = -.39$, $p = .033$.

Table 6. Correlations with Affect, Total Sample

	Base, PA	**Post, PA**	**Base, NA**	**Post, NA**
Base, Belonging	.28**	.20*	-.25**	-.22*
Post, Belonging	.02	.20*	-.09	-.38***
Base, Self-Esteem	.38**	.30**	-.29**	-.16
Post, Self-Esteem	.16	.33**	-.14	-.34***
Base, Meaningful Existence	.12	.04	-.16	-.17
Post, Meaningful Existence	.02	.22*	-.02	-.28**
Base, Control	.36**	.36***	-.19*	-.09
Post, Control	-.27**	.26**	.002	-.24**

Note. PA = Positive Affect; NA = Negative Affect; Post = post-manipulation measurement.

*$p < .05$, **$p < .01$, ***$p < .001$.

Overall, pre- and post-manipulation levels of positive affect were positively correlated, $r(115) = .80$, $p < .001$, as were pre- and post-manipulation levels of negative affect, $r(115) = .47$, $p < .001$. These correlations were positive and significant for all experimental conditions. However, there were no significant associations between positive and negative affect during concurrent measurements or cross-time measurements in the overall sample or within any of the experimental condition groups.

Table 7. Correlations among Measure of Affect, Total Sample

	Base, PA	**Post, PA**	**Base, NA**
Post, Positive Affect	.80***		
Base, Negative Affect	.11	.07	
Post, Negative Affect	.12	-.05	.47***

Note. PA = Positive Affect; NA = Negative Affect; Post = post-manipulation measurement.

*$p < .05$, **$p < .01$, ***$p < .001$.

Needs Satisfaction. Overall, there were several significant associations among the different dimensions of basic needs satisfaction (belonging, self-esteem, meaningful existence, and control), and all were positive. In general, concurrent associations (associations among baseline measures and associations among post-manipulation measures, respectively) were stronger than correlations between dimensions across measurement periods. However, some cross-time correlations were significant. For example, higher levels of belonging at baseline were associated with higher levels of self-esteem post-manipulation, $r(123) = .25$, $p = .005$, and higher levels of self-esteem at baseline were associated with higher levels of both belonging, $r(123) = .18$, $p = .046$, and control, $r(123) = .22$, $p = .017$, following the manipulation. Similarly, higher levels of meaningful existence and higher levels of control at baseline were both associated with higher self-esteem post-manipulation ($r(123) = .19$, $p = .039$, and $r(123) = .36$, $p < .001$, respectively).

Patterns of correlations among the dimensions of basic needs indicated some differences in associations among those who experienced acceptance versus rejection. For example, higher levels of belonging, self-esteem, meaningful existence, and control at baseline were all significantly associated with higher levels of belonging post-manipulation among participants who experienced acceptance, all $r > .38$, all $p < .003$, but there were no significant associations of baseline measures with post-manipulation belonging among participants who experienced rejection, all $r < .16$, all $p > .05$. Similarly, meaningful existence and control needs were positively associated both during concurrent and cross-time measurements for participants who were accepted, all $r > .33$,

all $p < .01$, but for participants who were rejected, only the concurrent correlations were significant, all $r > .54$, all $p < .001$; baseline levels of control were not significantly associated with post-manipulation levels of meaningful existence and baseline levels of meaningful existence were not significantly associated with post-manipulation levels of control for rejected participants. In contrast, higher levels of self-esteem at baseline were only associated with higher levels of control post-manipulation for participants who experienced rejection, $r(58) = .30$, $p = .024$.

Table 8. Correlations Among Needs Satisfaction Measures, Total Sample

	Base, Belong	**Post, Belong**	**Base, SE**	**Post, SE**	**Base, ME**	**Post, ME**	**Base, Control**
Post, Belong	.10						
Base, SE	.65***	.18*					
Post, SE	.25**	.74***	.43***				
Base, ME	.61***	-.03	.61***	.19*			
Post, ME	.11	.85***	.15	.69***	.04		
Base, Control	.49***	.07	.60***	.36***	.57***	.14	
Post, Control	.12	.80***	.22*	.72***	.07	.94***	.22*

Note. PA = Positive Affect; NA = Negative Affect; Post = post-manipulation measurement.
*$p < .05$, **$p < .01$, ***$p < .001$.

Fear of Negative Social Evaluation. Fear of negative social evaluation was not significantly associated with cortisol levels at any of the measurements but was associated with affect and basic needs satisfaction measures both pre and post-manipulation. Overall, respondents who scored higher on fear of negative social evaluation also reported lower levels of positive affect, $r(120) = -.27$, $p = .003$, and higher levels of negative affect, $r(120) = .28$, $p = .002$, at baseline, as well as lower levels of needs satisfaction on all dimensions at baseline, all $r > -.32$, all $p < .001$.

Participants who scored higher on fear of negative social evaluation also reported lower levels of positive affect following the manipulation, $r(115) = -.28$, $p = .002$, but this correlation was only significant among respondents who were rejected, $r(56) = -.42$, $p = .001$, and only reached significance for those rejected in the Cyberball manipulation, $r(25) = -.57$, $p = .003$. Higher levels of fear of negative social evaluation were also associated with higher levels of negative affect following the manipulation, $r(115) = .23$, $p = .014$, but this association was only significant for participants who experienced acceptance, $r(59) = .45$, $p < .001$.

Fear of negative social evaluation was not significantly associated with levels of belonging following the manipulation in the overall sample, but higher levels of fear of negative social evaluation were associated with lower levels of belonging post-manipulation for participants who were experienced acceptance in the Future Life manipulation, $r(31) = -.41$, $p = .023$. Likewise, there was also no overall association between fear of negative social evaluation and feelings of control after the manipulation, but for participants who experienced rejected in the Future Life manipulation, higher fear of negative social evaluation was associated with lower levels of control post-manipulation, $r(31) = -.45$, $p = .011$.

Overall, participants who scored higher on fear of negative social evaluation reported lower levels of self-esteem both before, $r(120) = -.53$, $p < .001$, and after the manipulation, $r(119) = -.32$, $p < .001$. While these associations were significant among participants in both the acceptance and rejection conditions, there were differences in these patterns across manipulations. Interestingly, the negative correlation between fear

of negative social evaluation and post-manipulation self-esteem was only significant for participants who were either accepted in the Cyberball manipulation, $r(30) = -.41$, $p = .024$, or who were rejected in the Future Life manipulation, $r(31) = -.43$, $p = .015$, although the association was approaching significance among those who were rejected in the Cyberball manipulation, $r(27) = -.37$, $p = .054$.

Table 9. Correlations with Fear of Negative Social Evaluation, Total Sample

	Fear of Negative Social Evaluation
Cortisol Sample 1	.07
Cortisol Sample 2	-.02
Cortisol Sample 3	.09
Baseline, Positive Affect	-.27**
Post-Manipulation, Positive Affect	-.28**
Baseline, Negative Affect	.28**
Post-Manipulation, Negative Affect	.23*
Baseline, Belonging	-.41***
Post-Manipulation, Belonging	.15
Baseline, Self-Esteem	-.53***
Post-Manipulation, Self-Esteem	-.32***
Baseline, Meaningful Existence	.35**
Post-Manipulation, Meaningful Existence	-.11
Baseline, Control	-.40***
Post-Manipulation, Control	.17

Note. PA = Positive Affect; NA = Negative Affect; Post = post-manipulation measurement.
*$p < .05$, **$p < .01$, ***$p < .001$.

Job Evaluation. Overall, participants who reported higher levels of positive affect following the manipulation provided more positive ratings on the job evaluation, $r(110) = .19$, $p = .045$. For respondents who experienced acceptance in the Future Life manipulation only, higher positive affect at baseline was also associated with more positive job evaluation ratings, $r(30) = .45$, $p = .014$; the association between post-manipulation positive affect and job ratings for these participants was approaching significance as well, $r(30) = .33$, $p = .074$, but not for other groups of participants.

Aside from this association with positive affect, there were no other significant associations with job evaluation ratings among participants who were accepted in either manipulation. However, job ratings were significantly associated with measures of cortisol, affect, and needs for respondents who experienced rejection, and these associations differed by manipulation type. Among participants rejected in the Cyberball manipulation, higher levels of negative affect following the rejection experience were associated with less positive ratings on the job evaluation measure, $r(25) = -.51$, $p = .009$, whereas among participants who were rejected in the Future Life manipulation, higher levels of cortisol at the final sample measurement were associated with less positive ratings on the job evaluation, $r(28) = -.41$, $p = .032$. Interestingly, among participants who experienced rejection in the Future Life manipulation, more positive job evaluation ratings were associated with lower levels of belonging, $r(28) = -.42$, $p = .027$, meaningful existence, $r(28) = -.44$, $p = .019$, and control, $r(28) = -.53$, $p = .004$, following the rejection experience.

Table 10. Correlations with Job Evaluation Ratings, Total Sample

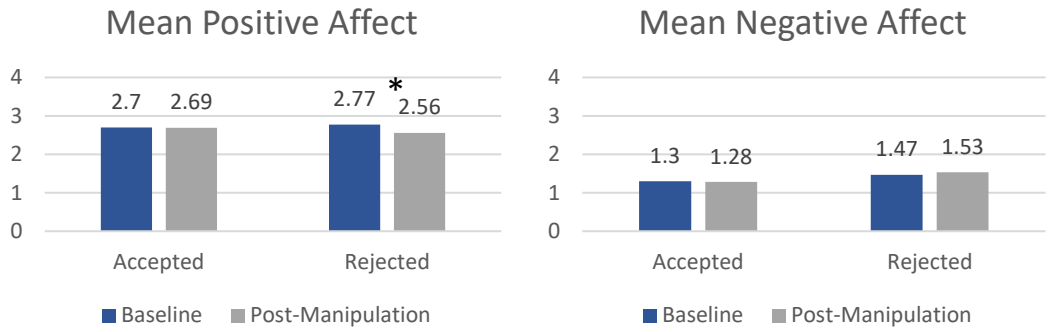
	Job Evaluation Ratings
Cortisol Sample 1	.08
Cortisol Sample 2	.01
Cortisol Sample 3	-.11
Baseline, Positive Affect	.12
Post-Manipulation, Positive Affect	.19*
Baseline, Negative Affect	-.13
Post-Manipulation, Negative Affect	-.16
Baseline, Belonging	.09
Post-Manipulation, Belonging	.07
Baseline, Self-Esteem	.12
Post-Manipulation, Self-Esteem	.06
Baseline, Meaningful Existence	-.02
Post-Manipulation, Meaningful Existence	.07
Baseline, Control	.02
Post-Manipulation, Control	.03

Note. PA = Positive Affect; NA = Negative Affect; Post = post-manipulation measurement.
*$p < .05$, **$p < .01$, ***$p < .001$.

Pre- to Post-Manipulation Changes

The summary below describes patterns of changes between participants' pre-manipulation versus post-manipulation reports of affect, basic needs, and cortisol, by condition and manipulation. Paired samples *T*-tests for constructs overall (combining all experimental groups) can be found in Appendix B.

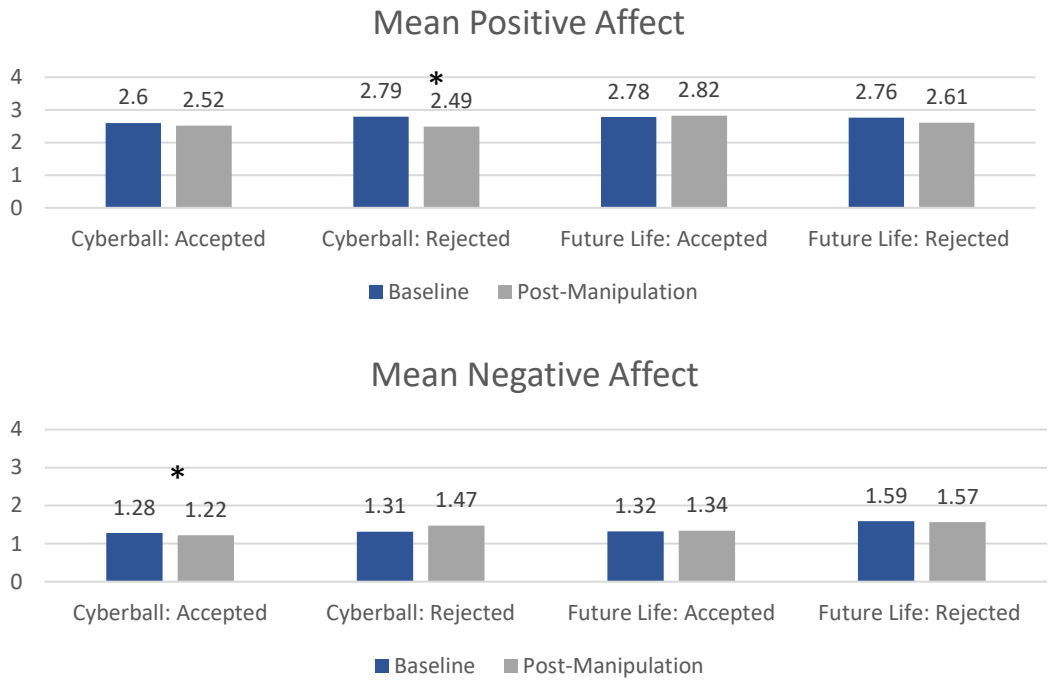
Affect. There was not a significant change in either positive or negative affect among participants who were accepted, but positive affect did significantly decrease among participants who were rejected, $t(56) = 2.87$, $p = .006$, Cohen's $d = 0.38$.



*Denotes significant difference.

Figure 5. Mean Positive and Negative Affect, by Condition

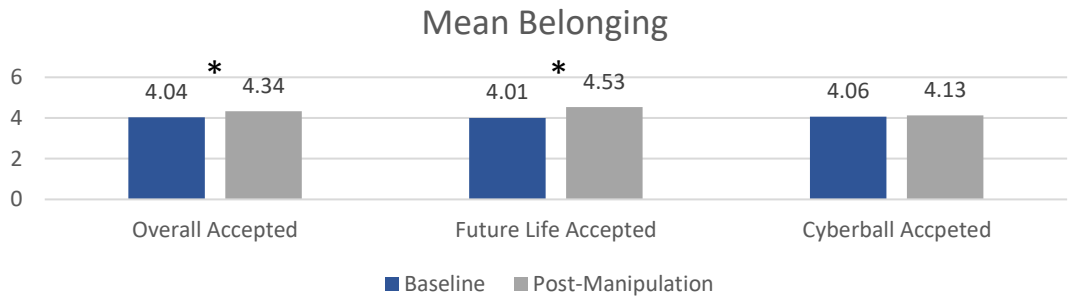
Analyzing the within-subject change in positive and negative affect separately for the Cyberball and Future Life manipulations revealed that only participants who were rejected in Cyberball (but not Future Life) exhibited a significant decrease in positive affect, $t(24) = 2.65$, $p = .014$, Cohen's d = 0.53. Additionally, there was a significant decrease in negative affect among participants who were accepted in the Cyberball but not the Future Life manipulation, $t(27) = 2.23$, $p = .035$, Cohen's d = 0.84.



*Denotes significant difference.

Figure 6. Mean Positive and Negative Affect, Condition x Manipulation

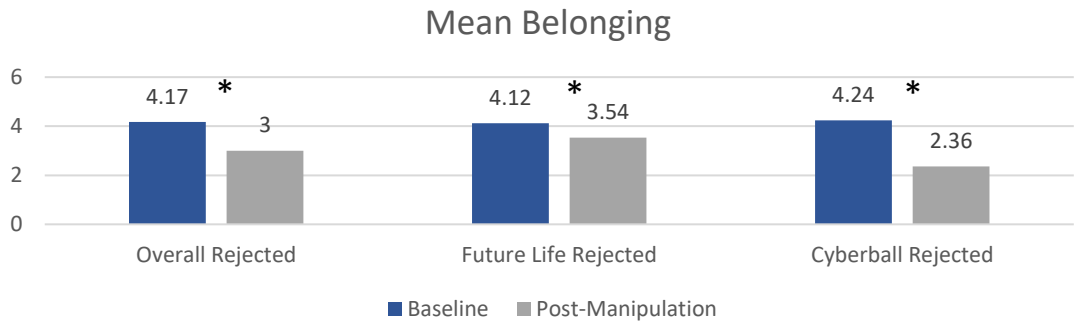
Belonging Needs. For measures of basic needs satisfaction, paired samples *T*-tests also indicated patterns of within-subject change that differed by condition and manipulation. Among those who were accepted, belonging significantly increased, $t(64) = -4.04$, $p < .001$, Cohen's $d = -0.51$. However, when analyzed separately by manipulation, the increase in belonging was only significant for those in the Future Life manipulation, $t(34) = -7.15$, $p < .001$, Cohen's $d = -1.23$.



*Denotes a significant difference.

Figure 7. Mean Belonging, by Acceptance Condition

Overall, participants who experienced rejection exhibited a significant decrease in feelings of belonging, $t(59) = 8.10$, $p < .001$, Cohen's $d = 1.05$. The decrease in belonging was statistically significant for those who experienced rejection in either the Future Life manipulation, $t(31) = 3.80$, $p = .001$, or the Cyberball manipulation, $t(26) = 10.13$, $p < .001$, but rejection in Cyberball produced a greater effect size (Cohen's $d = 1.95$) than rejection in Future Life (Cohen's $d = 0.67$).

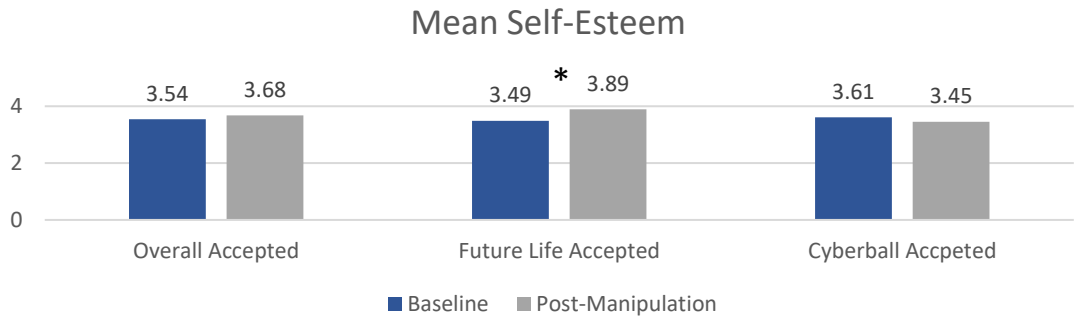


*Denotes a significant difference.

Figure 8. Mean Belonging, by Rejection Condition

Self-Esteem Needs. There was not a significant change in self-esteem for participants who were accepted overall, but for participants who were accepted in the

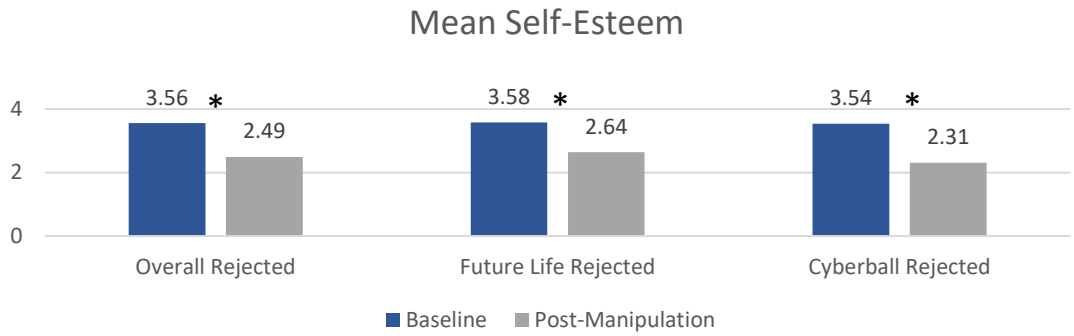
Future Life manipulation, specifically, there was a statistically significant increase in self-esteem, $t(33) = -3.75$, $p = .001$, Cohen's $d = -0.20$.



*Denotes a significant difference.

Figure 9. Mean Self-Esteem, by Acceptance Condition

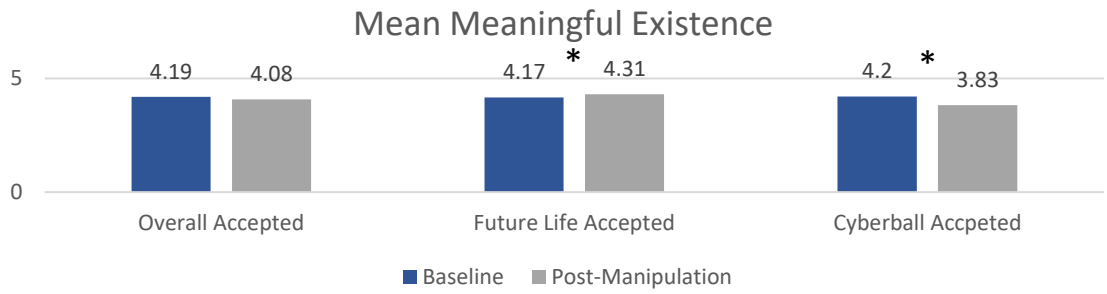
For participants who experienced social rejection, however, there was a statistically significant decrease in self-esteem between the pre-manipulation and post-manipulation self-reports, $t(58) = 10.30$, $p < .001$, Cohen's $d = 1.34$. This effect was evident and significant for both the Future Life, $t(31) = 5.60$, $p < .001$, and Cyberball, $t(26) = 11.42$, $p < .001$, rejection manipulations, but the effect was larger for the Cyberball manipulation of rejection (Cohen's $d = 2.20$) compared to the Future Life manipulation (Cohen's $d = 0.99$).



*Denotes a significant difference.

Figure 10. Mean Self-Esteem, by Rejection Condition

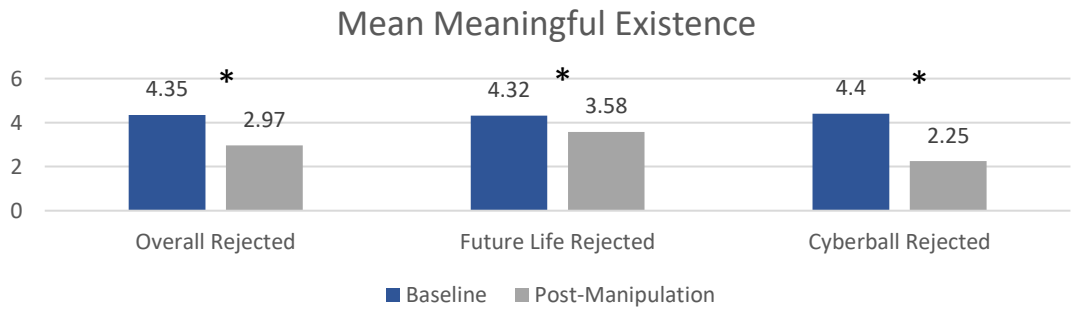
Meaningful Existence Needs. Overall, there was not a significant change in self-reports of meaningful existence between pre-manipulation and post-manipulation measurements among those who were accepted, $t(63) = 1.13$, $p = .262$, Cohen's $d = 0.14$. However, this is qualified by significant, but opposing, effects within the Future Life and Cyberball acceptance conditions: for those accepted in the Future Life manipulation, there was a significant increase in meaningful existence, $t(33) = -2.19$, $p = .036$, Cohen's $d = -0.38$, whereas there was a significant decrease in meaningful existence among those accepted in the Cyberball manipulation, $t(29) = 2.29$, $p = .030$, Cohen's $d = 0.42$.



*Denotes a significant difference.

Figure 11. Mean Meaningful Existence, by Acceptance Condition

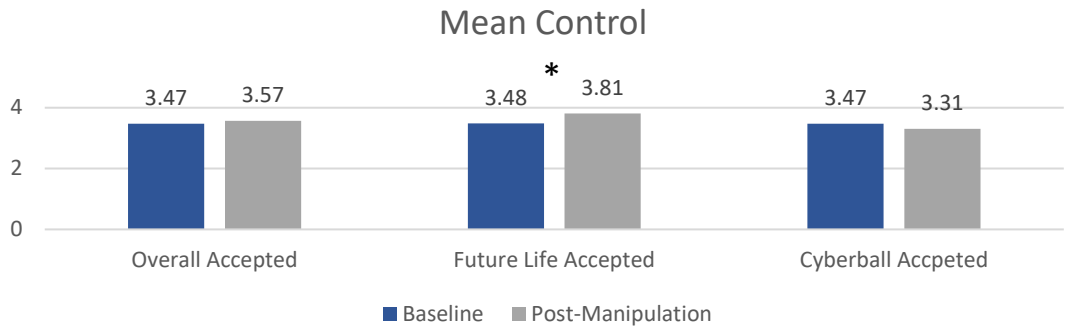
Among those who experienced social rejection, there was a significant decrease in self-reported meaningful existence between the pre- and post-manipulation measures, $t(58) = 9.35$, $p < .001$, Cohen's $d = 1.22$. This effect was statistically significant in both the Future Life, $t(31) = 5.16$, $p < .001$, and Cyberball, $t(26) = 11.26$, $p < .001$, rejection conditions, but the effect was stronger in the Cyberball manipulation (Cohen's $d = 2.17$) than in the Future Life manipulation (Cohen's $d = 0.91$).



*Denotes a significant difference.

Figure 12. Mean Meaningful Existence, by Rejection Condition

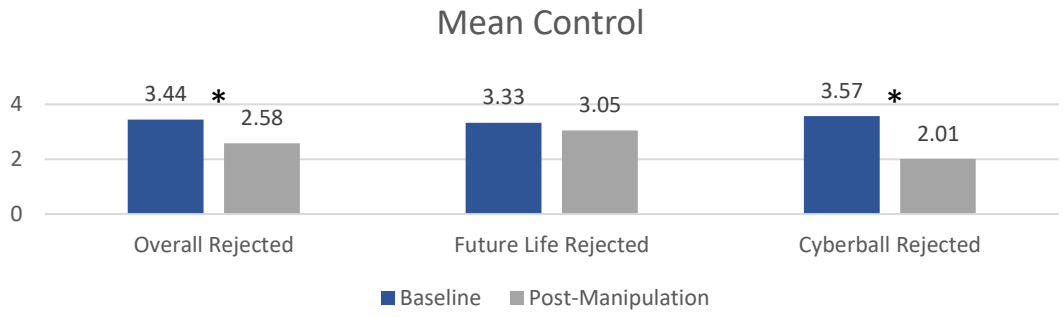
Control Needs. There was not a significant change in reports of control between the pre-manipulation and post-manipulation measures for participants who were accepted, overall. There was also no significant change in control needs for participants accepted in the Cyberball manipulation, but for participants accepted in the Future Life manipulation, there was a significant increase in perceptions of control, $t(33) = -2.77$, $p = .009$, Cohen's $d = -0.48$.



*Denotes a significant difference.

Figure 13. Mean Control, by Acceptance Condition

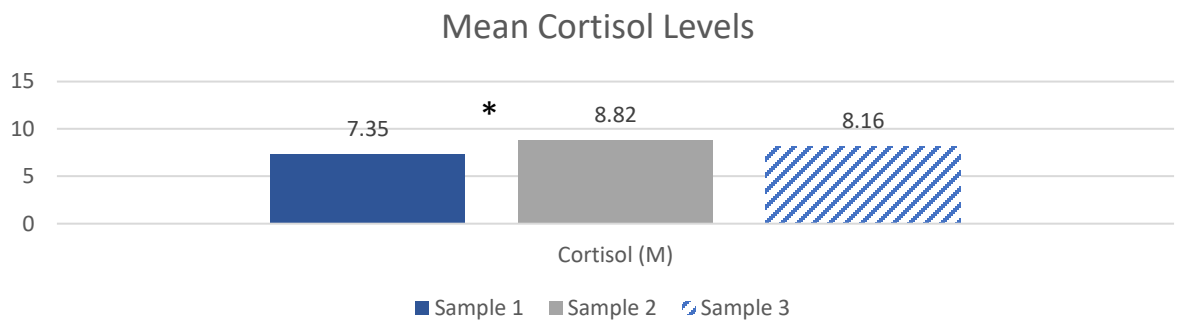
There was a statistically significant decrease in perceptions of control between pre-manipulation and post-manipulation measures for participants who were rejected, $t(58) = 5.81$, $p < .001$, Cohen's $d = 0.76$. Analyzing separately by manipulation type showed a significant decrease in control needs for participants rejected in the Cyberball manipulation, $t(26) = 9.25$, $p < .001$, Cohen's $d = 1.78$, but no significant change in control needs for participants rejected in the Future Life manipulation, $t(31) = 1.56$, $p = .130$, Cohen's $d = 0.28$.



*Denotes a significant difference.

Figure 14. Mean Control, by Rejection Condition

Cortisol. Because there were three measurements of cortisol, repeated measures GLM (general linear model) analyses were used to assess change over time in cortisol levels. Results indicated significant change over time in cortisol levels, $F(2, 62) = 3.38$, $p = .036$. Within-subjects contrast tests showed that the change in cortisol over the three measurements was best represented by a quadratic trend, $F(1, 110) = 4.84$, $p = .030$; the linear trend was not significant, $F(1, 110) = 1.99$, $p = .161$. Pairwise comparisons indicated that only the difference between baseline (Sample 1) and post-manipulation (Sample 2) measures was statistically significant, *M* difference = -1.47, SE = 0.58, $p = .036$, [-2.88, -0.07]: cortisol levels were significantly higher post-manipulation ($M = 8.82$, SE = 0.76) than at baseline ($M = 7.35$, SE = 0.51).

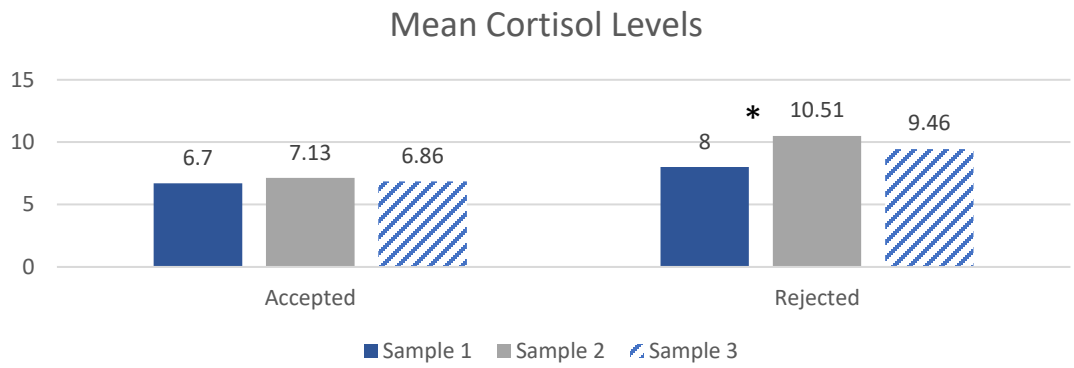


*Denotes a significant difference.

Figure 15. Mean Cortisol Levels, Total Sample

Tests of between-subjects effects also indicated a significant effect by condition, $F(1, 110) = 4.26$, $p = .041$. Pairwise comparisons indicated that the difference between cortisol levels among those who were accepted versus rejected was significant only for the post-manipulation measure of cortisol (Sample 2), *M* difference = 3.38, SE = 1.52, $p = .028$, [0.38, 6.38], $F(1, 110) = 4.96$, $p = .028$. Participants who were rejected had

significantly higher levels of cortisol (M = 10.51, SE = 1.08) compared to participants who were accepted (M = 7.13, SE = 1.07). Furthermore, the change in cortisol levels between measurements was only significant between the baseline (Sample 1) and post-manipulation (Sample 2) measurements, and only for participants who experienced rejection, M difference = 2.52, SE = 0.82, p = .008, [0.52, 4.50]: for rejected participants, cortisol levels were significantly higher following the rejection experience (M = 10.51, SE = 1.08) compared to baseline (M = 8.00, SE = 0.73).

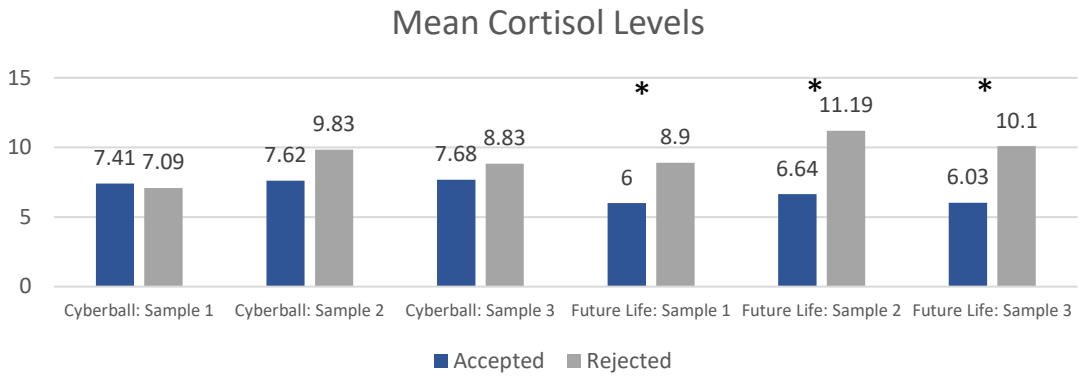


*Denotes a significant difference.

Figure 16. Mean Cortisol Levels, by Condition

Pairwise comparisons also indicated that for participants in the Future Life manipulation only, the difference in cortisol levels difference between participants who experienced acceptance versus rejection was significant for baseline (Sample 1), M difference = 2.92, SE = 1.39, p = .038, [0.17, 5.66], F(1,110) = 4.43, p = .038, post-manipulation (Sample 2), M difference = 4.54, SE = 2.05, p = .029, [0.49, 8.60], F(1,110) = 4.93, p = .029, and final (Sample 3) cortisol measurements, M difference = 4.06, SE = 1.95, p = .040, [0.19, 7.93], F(1,110) = 4.33, p = .040. At all timepoints, cortisol levels

were higher among participants who were rejected in the Future Life manipulation compared to participants who were accepted in the Future Life manipulation.



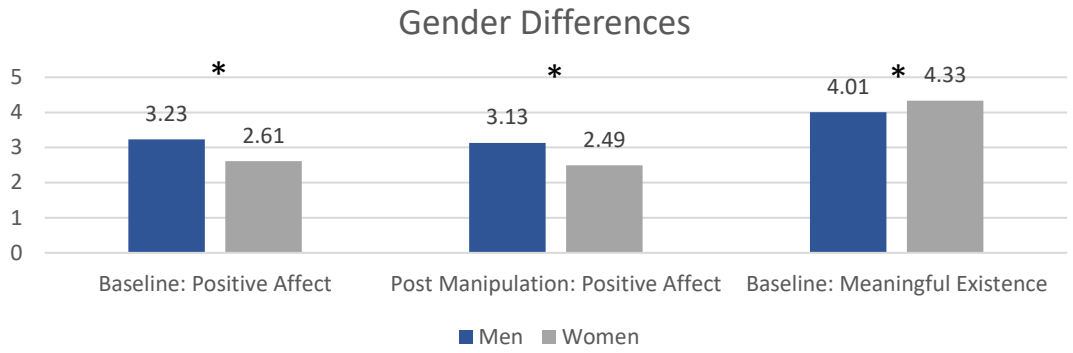
*Denotes a significant difference.

Figure 17. Mean Cortisol Levels, Condition x Manipulation

Demographic Differences

Gender Differences

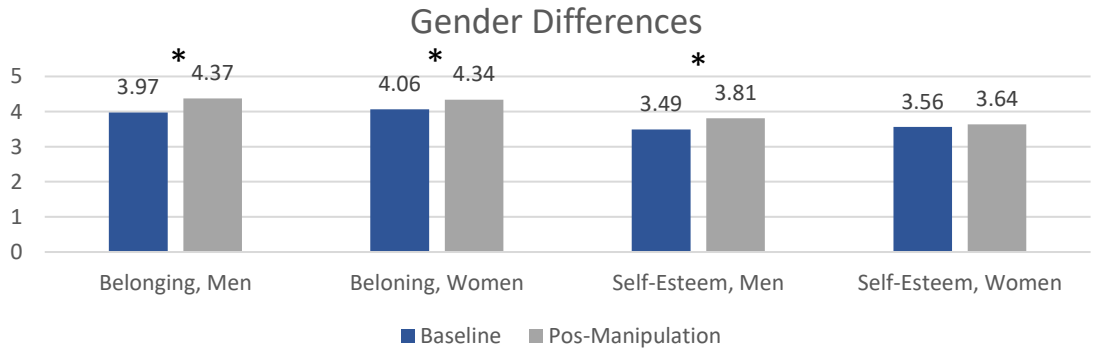
Independent samples *T*-tests indicated that men reported greater levels of positive affect than women both pre-manipulation, $t(123) = 3.98$, $p < .001$, Cohen's $d = 0.88$, and post-manipulation, $t(123) = 3.57$, $p = .001$, Cohen's $d = 0.82$. Women reported higher levels of meaningful existence at the pre-manipulation measurement, $t(123) = -3.03$, $p = .003$, Cohen's $d = -0.67$. There were no other significant differences, including no significant differences in job evaluation ratings.



*Denotes a significant difference.

Figure 18. Gender Differences in Self-Report Measures

For participants who were accepted, paired *t*-tests indicated a significant increase in belonging between pre- and post-manipulation measures for both men, $t(14) = -2.48$, $p = .027$, and women, $t(49) = -3.22$, $p = .002$, with a stronger effect among men (Cohen's $d = -0.64$) compared to women (Cohen's $d = -0.46$). For men only, there was also a significant increase is self-esteem, $t(14) = -2.51$, $p = .025$, Cohen's d = -0.65.



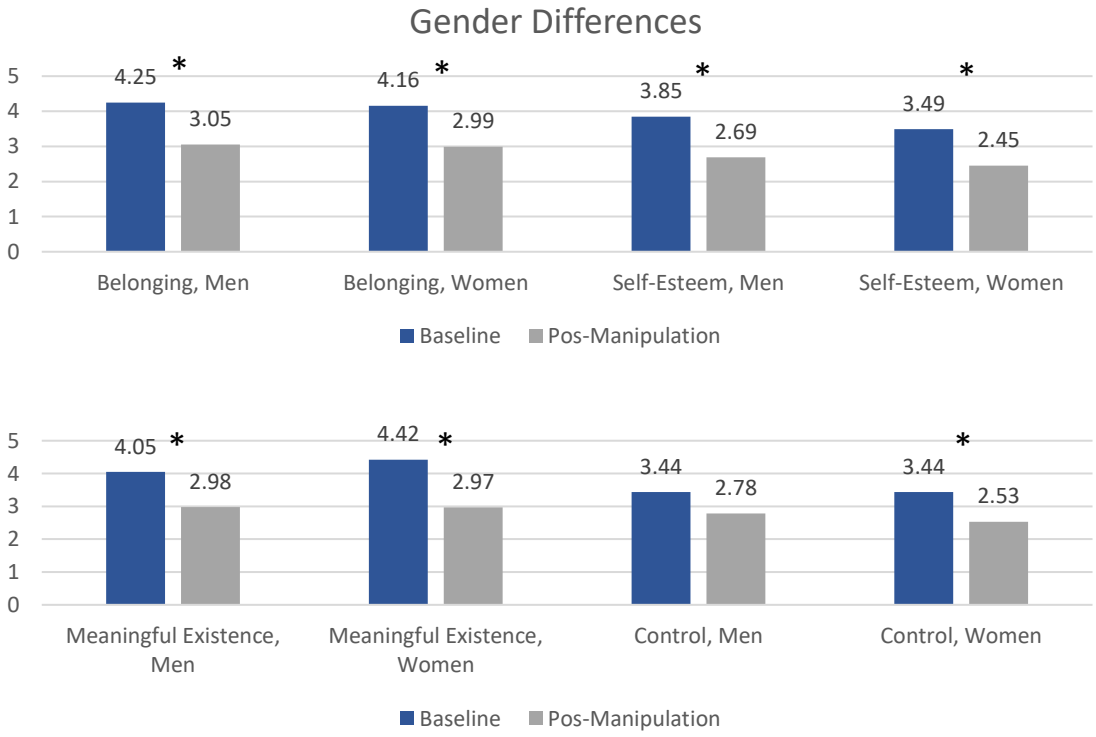
*Denotes a significant difference.

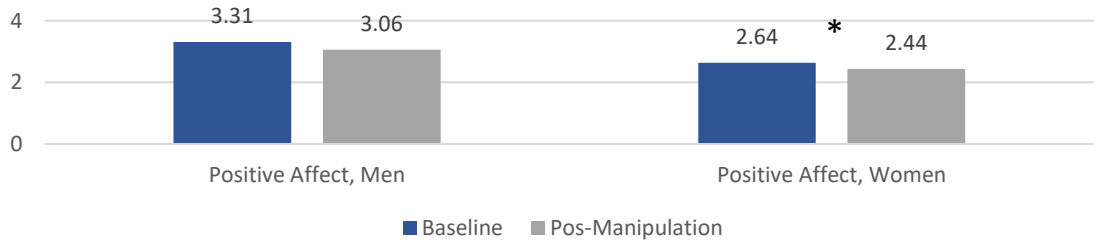
Figure 19. Gender Differences in Pre-Post Manipulation Changes, Acceptance Condition

Among participants who were rejected, there was a significant decrease in self-reported belonging between pre- and post-manipulation measures, for both men, $t(10) =$

3.57, $p = .005$, Cohen's $d = 1.08$, and women, $t(47) = 7.19$, $p < .001$, Cohen's $d = 1.04$. There was also a significant decrease in self-esteem for both men, $t(10) = 3.66$, $p = .004$, and women, $t(47) = 9.82$, $p < .001$, with a slightly stronger effect among women (Cohen's $d = 1.42$) compared to men (Cohen's $d = 1.10$). The decrease in meaningful existence was also significant for both men, $t(10) = 2.92$, $p = .015$, and women, $t(47) = 9.02$, $p < .001$, with a greater effect size for women (Cohen's $d = 1.30$) compared to men (Cohen's $d = 0.88$).

For rejected participants, there was also a significant decrease in perceptions of control between pre- and post-manipulation measures, but only for women, $t(47) = 5.51$, $p < .001$, Cohen's $d = 0.80$. The decrease in positive affect was also only significant among women, $t(45) = 5.51$, $p = .010$, Cohen's $d = 0.40$.

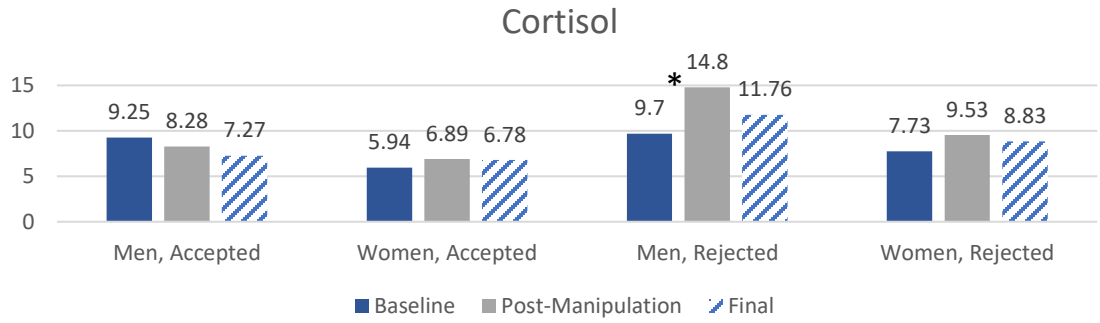




*Denotes a significant difference.

Figure 20. Gender Differences in Pre-Post Manipulation Changes, Rejection Condition

Repeated measures GLM indicated that there were no interactions between cortisol and gender at either the within-subjects or between-subjects levels. However, cortisol levels were higher among men than women at all measurements and pairwise comparisons indicated that this difference approached significance at baseline measurement (Sample 1), *M* difference = 2.64, SE = 1.35, $p = .053$, [-0.04, 5.32], $F(1, 105) = 3.83$, $p = .053$. Furthermore, there was only a statistically significant increase in levels of cortisol post-rejection (Sample 2) relative to baseline (Sample 1) for men, *M* difference = 5.10, SE = 2.10, $p = .050$, [-0.02, 10.22].

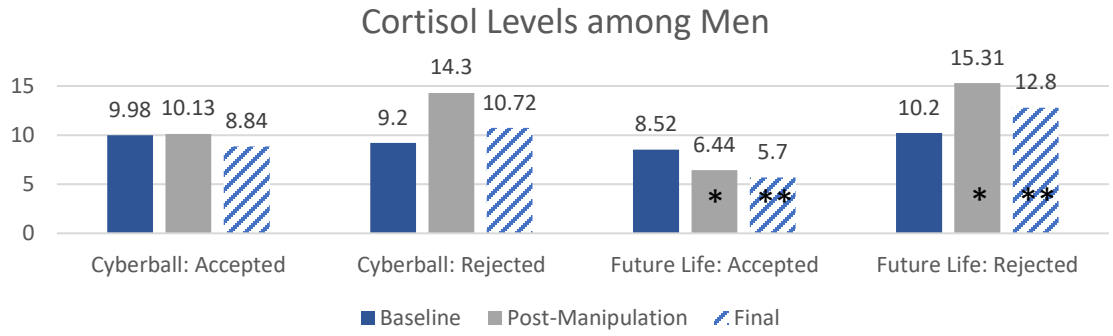


*Denotes a significant difference.

Figure 21. Gender Differences in Cortisol, by Condition

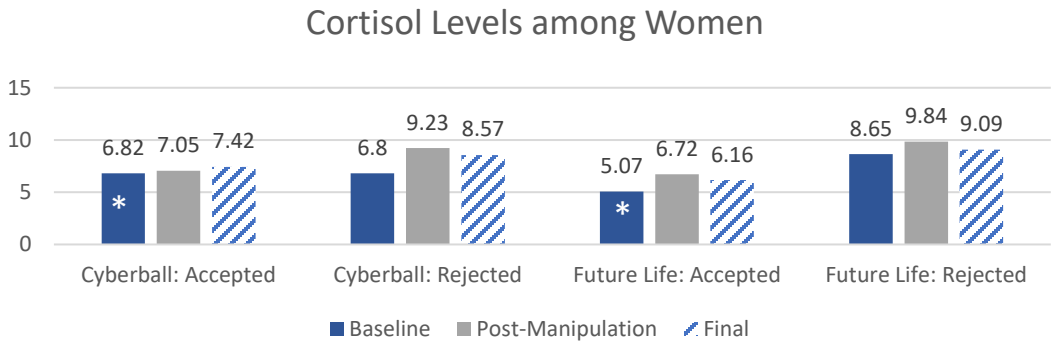
For both men and women in the Cyberball manipulation, there was no significant difference in cortisol levels between accepted and rejected participants at any of the three

measurements. However, among those who participated in the Future Life manipulation, baseline (Sample 1) cortisol levels were significantly higher among women in the rejection condition, *M* difference = 3.58, SE = 1.61, *p* = .028, [0.39, 6.78], than in the acceptance condition, but for men there was no significant difference at baseline. Instead, for men in the Future Life manipulation, cortisol levels were significantly higher post-manipulation (Sample 2) among those who experienced rejection compared to those who experienced acceptance, *M* difference = 8.87, SE = 4.18, *p* = .036, [0.58, 17.17]. For men in the Future Life manipulation, cortisol levels were also higher in the final sample (Sample 3) among those who experienced rejection relative to those who experienced acceptance, but this difference was approaching significance only, *M* difference = 7.10, SE = 4.03, *p* = .081, [-0.89, 15.09].



*Denotes a significant difference.

Figure 22. Cortisol Levels Among Men, Condition x Manipulation

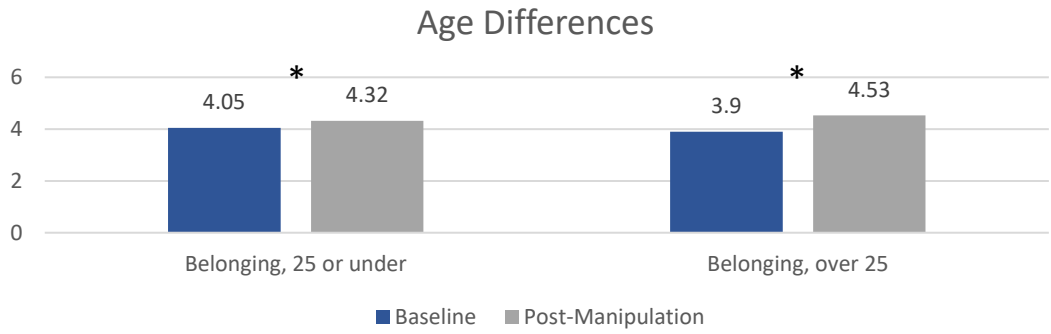


*Denotes a significant difference.

Figure 23. Cortisol Levels Among Women, Condition x Manipulation

Age Differences

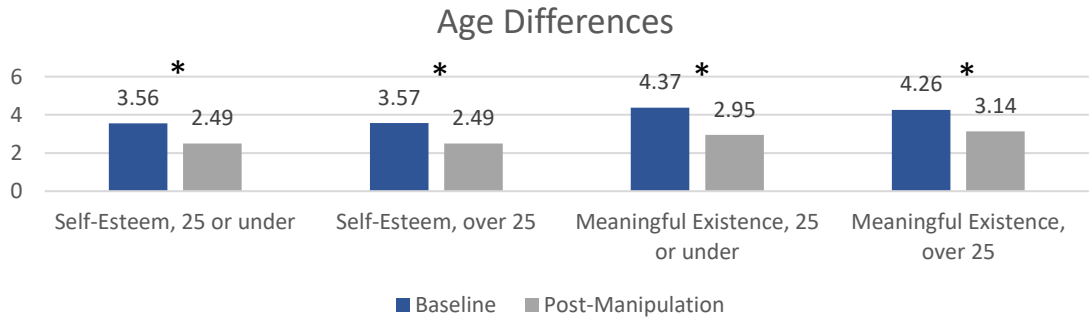
Overall, there were no significant differences on self-report measures by age (comparing participants ages 25 and under to participants over 25) at either the pre- or post-manipulation measurement, including no significant differences in job evaluation ratings. Paired sample *t*-tests showed that patterns of change between pre-manipulation and post-manipulation self-reports were similar for both age groups. For participants who were accepted, there was a significant increase in belonging for both participants ages 25 and under, $t(55) = -3.21$, $p = .002$, and participants over 25, $t(7) = -3.38$, $p = .012$, but the effect was greater for participants over 25 (Cohen's $d = -1.20$) than those 25 and under (Cohen's $d = -0.43$).

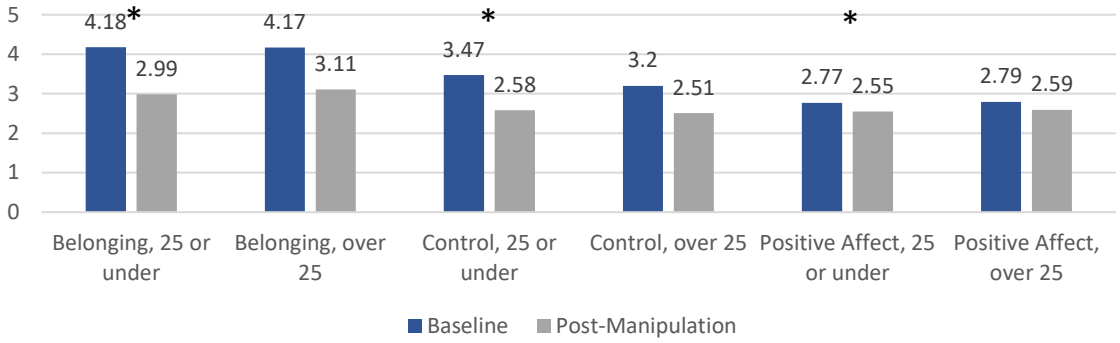


*Denotes a significant difference.

Figure 24. Age Differences in Pre-Post Manipulation Changes, Acceptance Condition

For participants who were rejected, there was a significant decrease in self-esteem for both participants 25 and under, $t(51) = 9.96$, $p < .001$, and participants over 25, $t(6) = 2.77$, $p = .033$, but the effect was slightly greater for the younger group (Cohen's $d = 1.38$ versus Cohen's $d = 1.05$). The decrease in meaningful existence was also significant for both participants 25 and under, $t(51) = 8.86$, $p < .001$, Cohen's $d = 1.10$, and participants over 25, $t(6) = 2.91$, $p = .027$, Cohen's $d = 1.23$. Although both age groups exhibited a decrease in belonging, control, and positive affect post- versus pre-manipulation, the effects were significant only for participants under 25.

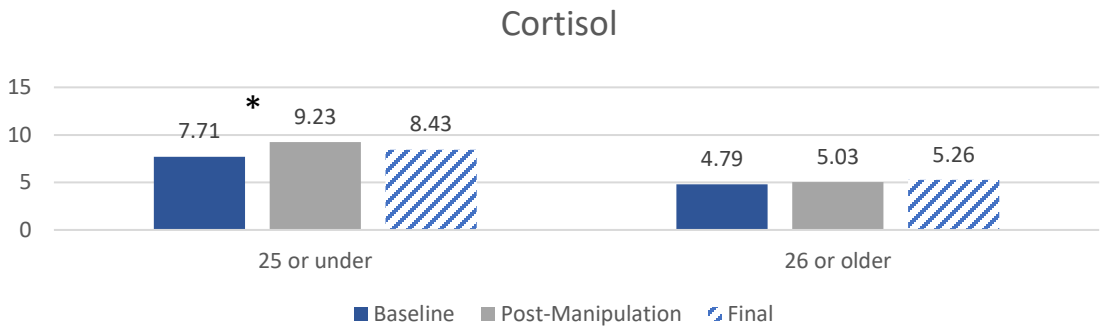




*Denotes a significant difference.

Figure 25. Age Differences in Pre-Post Manipulation Changes, Rejection Condition

Repeated measures GLM of cortisol levels indicated that there were no significant within-subjects or between-subjects effects for age. (Although, note that there were only 14 participants ages 26 or older.) However, the increase in post-manipulation cortisol levels (Sample 2) relative to baseline (Sample 1) was only significant for participants 25 or younger, *M* difference = 1.52, SE = 0.63, *p* = .050, [0.002, 3.04].

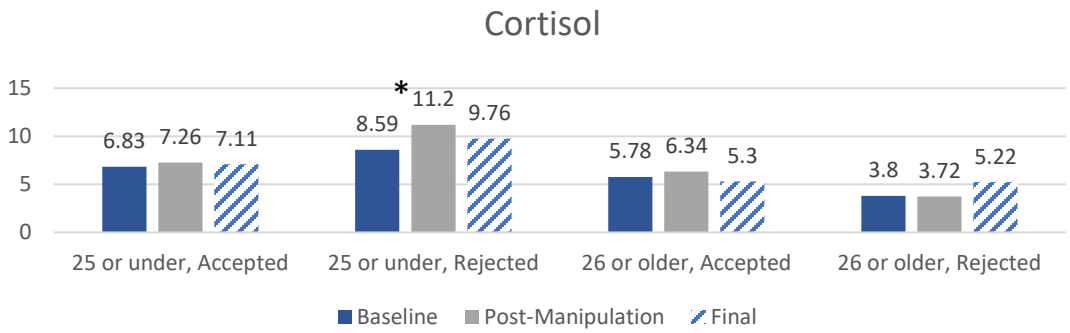


*Denotes a significant difference.

Figure 26. Age-Differences in Cortisol Levels

There was only a significant difference in cortisol levels between participants in the rejection and acceptance conditions among participants ages 25 or younger and only post-manipulation (Sample 2), *M* difference = 3.94, SE = 1.62, *p* = .017, [0.72, 7.16],

$F(1,105) = 5.89$, $p = .017$, such that post-manipulation cortisol levels were higher among those who experienced rejection ($M = 11.20$, SE = 1.14) compared to those who experienced acceptance ($M = 7.26$, SE = 1.16). Additionally, the change in pre-to-post manipulation cortisol levels was only significant among participants who experienced rejection who were 25 or under, M difference = 2.61, SE = 0.88, $p = .011$, [0.47, 4.75].



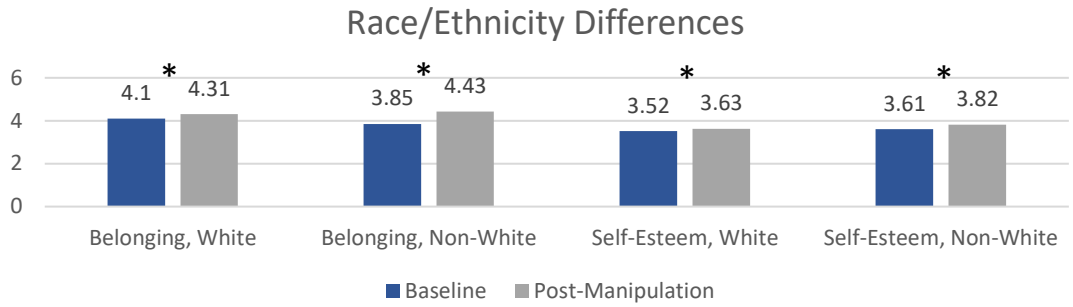
*Denotes a significant difference.

Figure 27. Age Differences in Cortisol Levels, by Condition

Race

Overall, there were no significant differences in any of the self-report measures as a function of race, including no significant differences in job evaluation ratings. Paired samples t-tests indicated a consistent pattern of effects for accepted and rejected participants as a function of race/ethnicity but some differences in effect size were observed. For example, among accepted participants, there was a significant increase in belonging pre- versus post-manipulation for both groups, but the effect was greater for non-White participants, $t(16) = -4.81$, $p < .001$, Cohen's d = -1.17, compared to White participants, $t(46) = -2.32$, $p = .025$, Cohen's d = -0.34. In contrast, the pre- to post-manipulation decrease in self-esteem among rejected participants was slightly greater

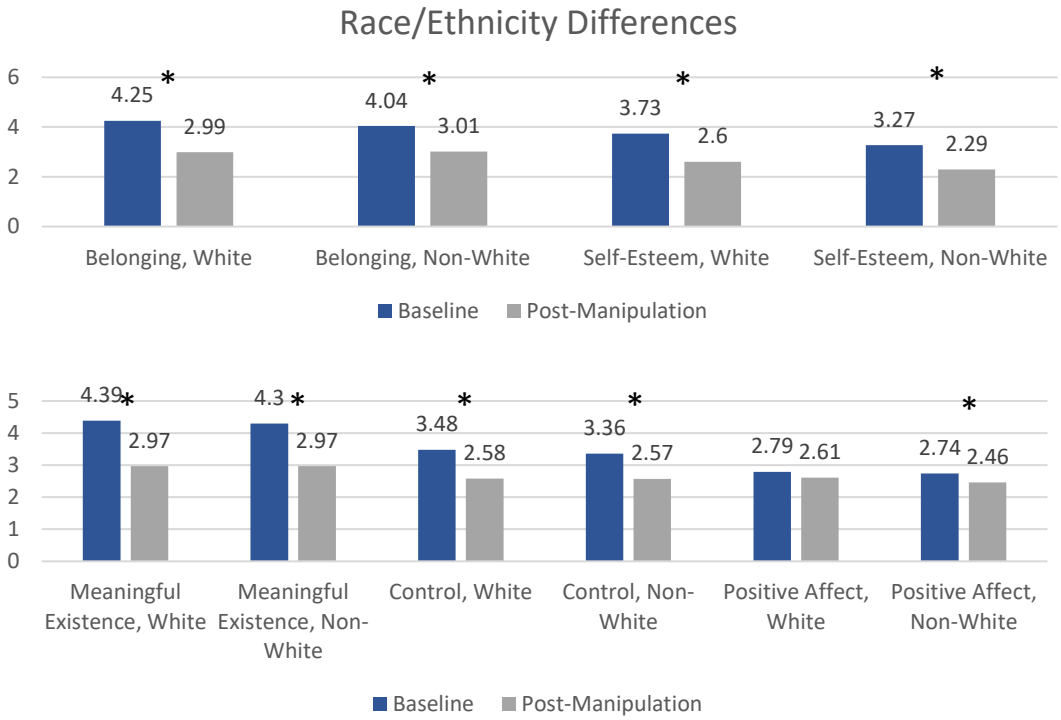
among White participants, $t(37) = 9.14$, $p < .001$, Cohen's d = 1.48, compared to non-White participants, $t(46) = 5.09$, $p < .001$, Cohen's d = 1.11.



*Denotes a significant difference.

Figure 28. Race/Ethnicity Differences in Pre-Post Manipulation Changes, Acceptance Condition

Among participants who experienced rejection, the overall pattern of pre- to post-manipulation changes were similar for both groups, but there was a significant decrease in positive affect only among non-White participants, $t(20) = 2.25$, $p = .036$, Cohen's d = 0.49. There was a slightly greater effect size for the post-rejection decreases in self-esteem for White participants (Cohen's d = 1.48) compared to non-White participants (Cohen's d = 1.11), and the same pattern was observed for changes in meaningful existence (Cohen's d = 1.29 versus Cohen's d = 1.08) and control (Cohen's d = 0.81 versus Cohen's d = 0.65).



*Denotes a significant difference.

Figure 29. Race/Ethnicity Differences in Pre-Post Manipulation Changes, Rejection Condition

Repeated-measures GLMs indicated that there were no significant within- or between-subjects effects for race/ethnicity with cortisol levels.

Regression Analysis of Behavioral Responses

For each of the following hierarchical regression models, the job evaluation measure was the dependent variable, regressed on the baseline measure of needs or affect in the first block and the post-manipulation measure of needs or affect, respectively, in the second block. Analyses were run separately by experimental group (condition x manipulation).

Positive Affect

For all experimental groups, post-manipulation positive affect was not a significant predictor of job evaluation ratings above and beyond baseline positive affect, and the addition of positive affect was not associated with significant improvement to the model.

Negative Affect

For participants who experienced rejection in the Cyberball manipulation only, post-manipulation negative affect was a significant predictor of job evaluation ratings, controlling for baseline levels of negative affect, $\beta = -.48$, $t = -2.65$, $p = .015$, such that higher levels of negative affect were associated with less positive job evaluation ratings. Baseline negative affect, however, was not significantly associated with job evaluation ratings. The regression model was only significant once post-manipulation negative affect was added to the model, $F(2,22) = 4.37$, $p = .025$, $R^2 = .28$, and post-manipulation negative affect accounted for 23% unique variance in job evaluation ratings, $\Delta F(1,22) = 7.02$, $p = .015$, $\Delta R^2 = .23$.

Belonging

Among participants who experienced acceptance, post-manipulation belonging was a significant predictor of job evaluation ratings, above and beyond baseline feelings of belonging, among those in the Future Life manipulation, $\beta = .53$, $t = 2.12$, $p = .044$; higher levels of belonging post-manipulation were associated with more positive job evaluation ratings. Feelings of belonging at baseline did not significantly predict job

evaluation ratings. Although the full regression model was not statistically significant, $F(2,27) = 2.27$, $p = .123$, $R^2 = .14$, post-manipulation belonging accounted for 14% of the variance in job evaluation ratings and did significantly improve the model, $\Delta F(1,27) = 4.48$, $p = .044$, $R^2 = .14$.

Among participants who experienced rejection, post-manipulation belonging was a significant predictor of job evaluation ratings above and beyond baseline levels of belonging for those in the Future Life manipulation only, $\beta = -.47$, $t = -2.53$, $p = .018$; lower levels of belonging post-manipulation were associated with more positive job evaluation ratings. Baseline levels of belonging did not significantly predict job evaluation ratings. The full regression model was not statistically significant but did approach significance, $F(2,25) = 3.21$ $p = .057$, $R^2 = .21$. Post-manipulation belonging accounted for 21% unique variance in job evaluation ratings and did significantly improve the model, $\Delta F(1,27) = 6.39$, $p = .018$, $\Delta R^2 = .20$.

Self-Esteem

Post-manipulation self-esteem was a significant predictor of job evaluation ratings, controlling for baseline levels of self-esteem, but only among participants who experienced rejection in the Cyberball manipulation, $\beta = .64$, $t = 2.74$, $p = .011$; higher levels of self-esteem post-manipulation were associated with more positive job evaluation ratings. Baseline self-esteem also predicted job evaluation ratings, but only after adding post-manipulation self-esteem, $\beta = -.51$, $t = 2.19$, $p = .038$, such that higher levels of baseline self-esteem were associated with less positive job evaluation ratings, controlling for post-manipulation self-esteem. The overall model accounted for 25% of the variance

in job evaluation ratings, $F(2,24) = 3.91$ $p = .034$, $R^2 = .25$. The addition of post-manipulation self-esteem accounted for 24% of the variance in job evaluation ratings and significantly improved the model, $\Delta F(1,24) = 7.53$, $p = .011$, $\Delta R^2 = .24$.

Meaningful Existence

Feelings of meaningful existence post-manipulation significantly predicted job evaluations ratings, controlling for baseline levels of meaningful existence, but only among those who experienced rejection in the Future Life manipulation, $\beta = -.48$, $t = -2.59$, $p = .016$, such that lower levels of meaningful existence post-manipulation were associated with more positive job evaluation ratings. Feelings of meaningful existence at baseline did not significantly predict job evaluation ratings. The full regression model was just beyond statistical significance thresholds, $F(2,25) = 3.36$ $p = .051$, $R^2 = .21$. Together the full model accounted for 21% of the variance in job evaluation ratings, but all of it was accounted for by the contribution of post-manipulation meaningful existence, $\Delta F(1,25) = 6.71$, $p = .016$, $\Delta R^2 = .21$.

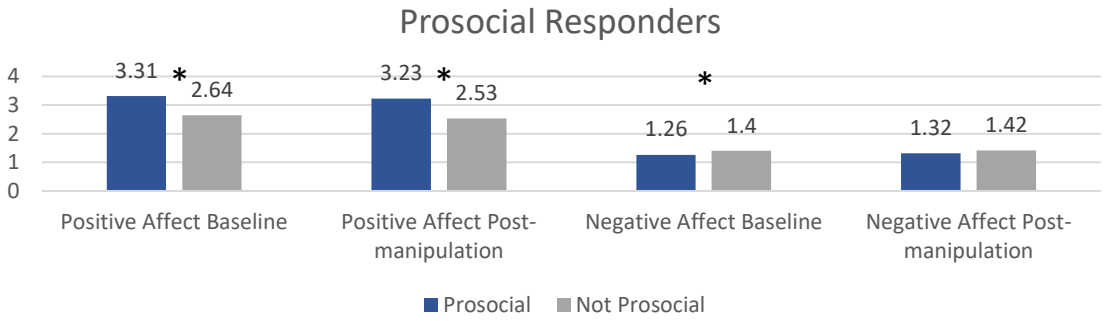
Control

Post-manipulation control significantly predicted job evaluation ratings above and beyond baseline feelings of control for participants who experienced rejection in the Future Life manipulation only, $\beta = -.53$, $t = -3.12$, $p = .005$; lower levels of control post-manipulation were associated with more positive job evaluation ratings. Feelings of control at baseline did not significantly predict job evaluation ratings. The full regression model was significant only after the addition of post-manipulation control, $F(2,25) = 4.87$

p = .016, R^2 = .28, and accounted for 28% of the variance in job evaluation ratings, all of which was attributed to post-manipulation control, $\Delta F(1,25) = 9.74$, p = .005, ΔR^2 = .28.

Prosocial Responders

Due to the low incidence of prosocial responses to the job evaluation measure, follow up analyses were conducted to better understand response patterns among this group. Because of the small sample size (n = 15), analyses used independent samples t-tests to compare between prosocial responders (above the scale midpoint) and non-prosocial responders (below the scale midpoint) on average job evaluation ratings. Overall, those who provided prosocial responses reported higher levels of positive affect at baseline, $t(118) = -3.36$, p = .001, and post-manipulation, $t(113) = -3.11$, p = .002, as well as lower levels of negative affect at baseline, $t(32.93) = 2.23$, p = .033. There were no other significant differences overall.

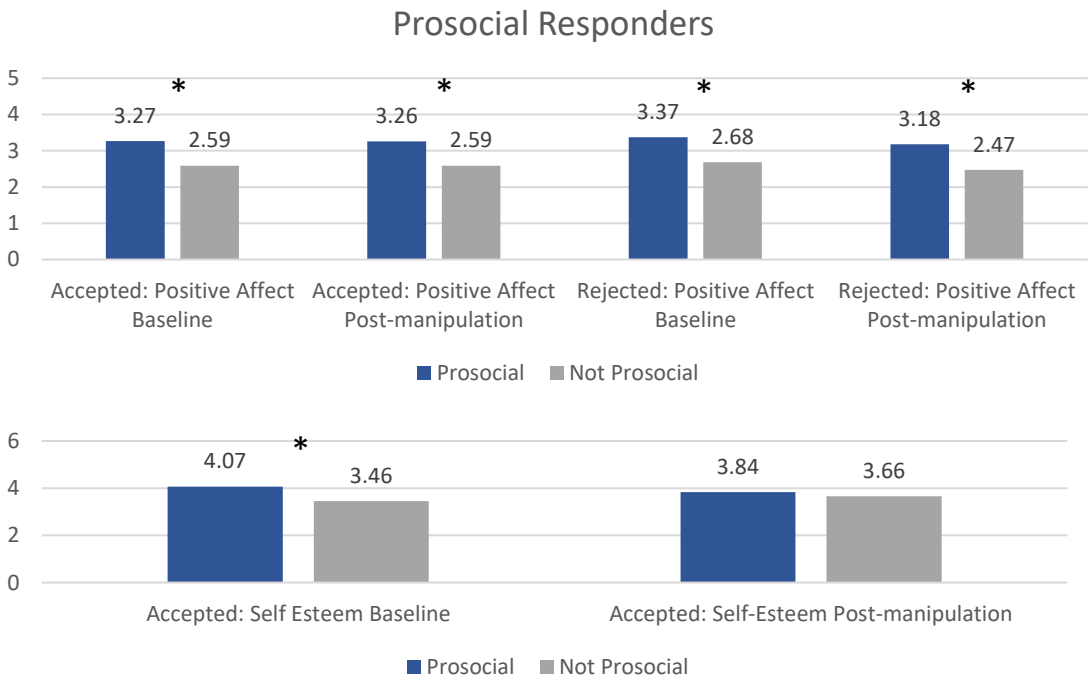


*Denotes a significant difference.

Figure 30. Differences in Positive and Negative Affect for Prosocial Responders

When viewed separately by acceptance and rejection conditions, higher positive affect at baseline was observed among prosocial responders both among those in the acceptance, $t(60) = -2.33$, p = .023, Cohen's d = -0.84, and rejection, $t(56) = -2.49$, p =

.016, Cohen's d = -1.07, conditions. Likewise, prosocial responders had higher levels of positive affect post-manipulation in both the acceptance, $t(57) = -2.23$, $p = .029$, Cohen's d = -0.81, and rejection, $t(54) = -2.00$, $p = .050$, Cohen's d = -0.94 conditions. Slightly greater effect sizes were observed in the rejection condition. However, only among participants who experienced acceptance, prosocial responders had higher levels of self-esteem at baseline as well, $t(60) = -2.55$, $p = .013$, Cohen's d = -0.92.



*Denotes significant difference.

Figure 31. Differences in Positive and Negative Affect for Prosocial Responders

Hypothesis Testing

Multilevel SEM analyses began with the building of the Level 1 (within-subjects model. It became evident that including cortisol, affect, and needs variables in the Level 1 model as described in the plan of analysis was not possible; doing so caused models to

fail to converge or result in untrustworthy estimates and standard errors. Several steps were taken to find a suitable alternative. For example, an attempt to substitute composite scores instead of latent factors did reduce model complexity but did not result in a suitable Level 1 model. Similarly, using log-transformed cortisol and standardized variables also did not result in a suitable Level 1 model. Attempts to reduce the number of variables included (i.e., including either positive *or* negative affect only or including one basic needs satisfaction measure at a time) also did not provide a suitable Level 1 model.

However, using a single within-subjects variable per model did allow for Level 1 analyses to process enough to ascertain patterns of within-subject change over time and evaluation of the associated within-subjects (Level 1) versus between-subjects (Level 2) variability for each variable. Thus, seven Level 1 models were created, as summarized below. Unfortunately, there was not a significant amount of between-subjects (Level 2) variability to proceed with Level 2 analyses for the measures of affect or any of the basic needs satisfaction dimensions.

Table 11. Summary of Variability in Constructs

Construct	Within-subject (Level 1)	Between-subject (Level 2)
Cortisol	0.15***	0.01*
Positive Affect	0.99***	< 0.001
Negative Affect	1.00***	0.002
Belonging	0.98***	< 0.001
Self-Esteem	0.95***	< 0.001
Meaningful Existence	0.86***	< 0.001
Control	0.97***	< 0.001

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$.

The analysis of the full multilevel structural equation model for cortisol is described below (see Figure 32). In the subsequent section, repeated measures GLMs were added as an alternative approach to assess patterns of change over time in affect and basic needs, including differences by condition and manipulation, while accounting for covariates. Additionally, because it was not possible to include the physiological and subjective measures in a single SEM model, a series of hierarchical regressions were added as an alternative approach to assess the interrelationships of changes in cortisol, affect, and basic needs satisfaction scales. All analyses were performed for the full sample and again excluding participants who did not fit the definition of emerging adults; there were no substantive differences in patterns of effects when limiting the sample to emerging adults only.

Multilevel Structural Equation Model for Cortisol

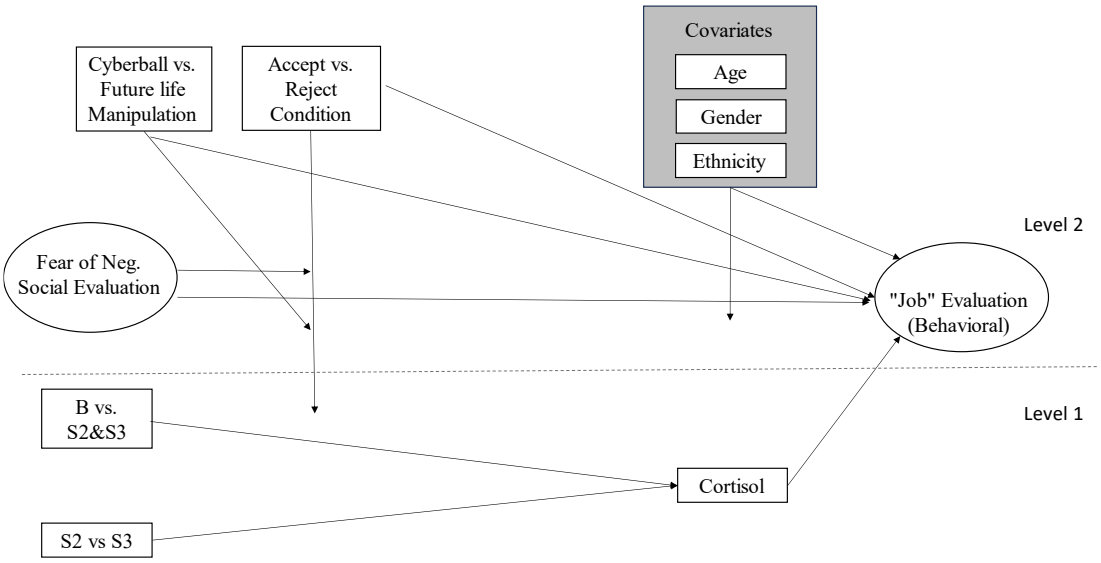


Figure 32. Multilevel SEM for Cortisol

The unconditional model (ssBIC = 724.61), which included only the measure of cortisol (log-transformed and standardized) indicated that there was significant variability in cortisol at the within-subject (variance = 0.19, SE = 0.02, $p < .001$) and between-subject levels (variance = 0.79, SE = 0.09, $p < .001$). Next, the first measure of change over time (comparing Sample 1 versus Samples 2 and 3) was added to the model as a fixed effect. This addition did not improve the model (ssBIC = 727.23) and the change-over-time effect was not statistically significant, $b = 0.004$, SE = .02, $p = .819$, but the within-subject and between-subject variability remained significant. Setting change-over-time to a random effect did lead to a slight improvement in the model (ssBIC = 724.41, ΔBIC = -2.82) and there was significant variability in cortisol at the within-subjects level (variance = 0.15, SE = 0.02, $p < .001$). At the between subjects' level, variability in

change-over-time for cortisol approached significance (variance = 0.01, SE = 0.01, p = .057).

Next the second change-over-time contrast was added to the model (comparing the Sample 2 and Sample 3 measurements) as a fixed effect. Adding this effect did not improve the model, and the effect was not statistically significant, b = -0.03, SE = 0.03, p = .233. Setting this effect to random also did not improve the model. However, with measures of change-over-time included, there was between-subjects variability in the effect of change-over-time in cortisol levels (var = 0.01, SE = 0.01, p = .050), allowing for Level 2 analyses to proceed. Adding age, gender, and race/ethnicity to the model as covariates did improve the model (ssBIC = 737.33, ΔBIC = -264.92), but there were no significant effects on cortisol or change-over-time in cortisol levels.

Next the condition (acceptance or rejection) was added to the model. There was no improvement to the model (ssBIC = 739.38) and no significant effects. Adding the manipulation (Cyberball or Future Life) to the model also did not improve the model (ssBIC = 744.44) or result in any significant effects. The interaction between condition and manipulation, added to the model next, did have a significant effect on cortisol levels overall, b = -0.17, SE = 0.08, p = .046, but there was no associated improvement in the model (ssBIC = 745.81, ΔBIC = 1.38).

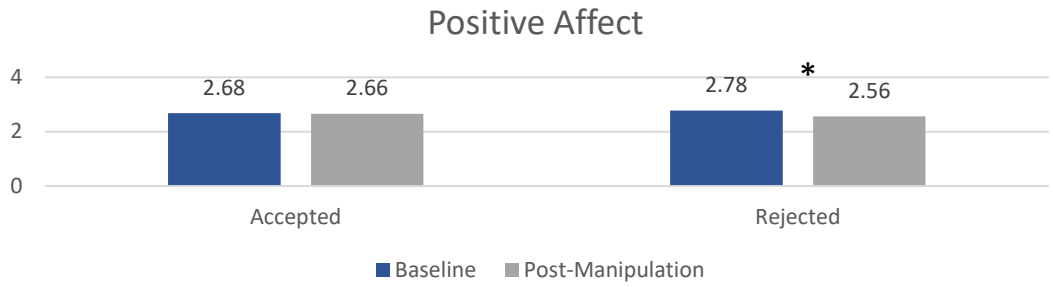
The next step was creating the latent factor for the job evaluation measure in the Level 2 (between-subjects) model. Adding the effect of change-over-time in cortisol on the job evaluation measure, accounting for the covariates (age, gender, and race/ethnicity) did not produce any significant effects or improvement to the model. Likewise, adding

the measure of fear of negative social evaluation at the between-subjects level and as an effect on cortisol, change over time in cortisol levels, and the job evaluation measure did not result in any significant effects or improvement to the model.

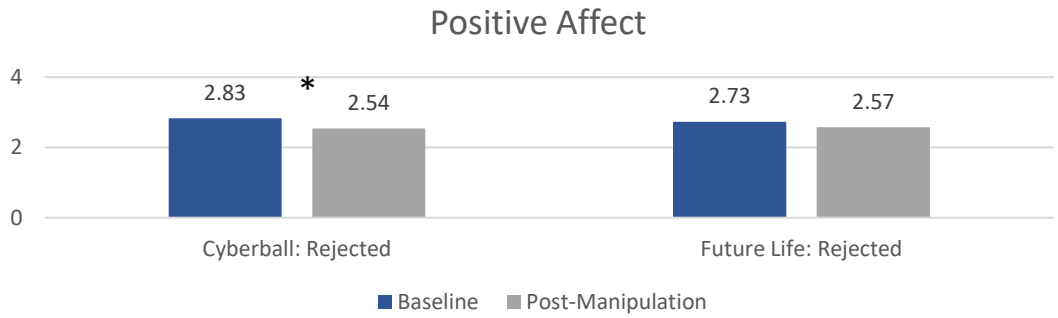
Follow-Up Analyses: Repeated Measures GLM

Each of the following models described was constructed with the same structure. In addition to the repeated-measures factor, condition (rejection or acceptance), manipulation (Future Life or Cyberball), and fear of negative social evaluation (high or low, based on a median-split) were included as between-subjects factors; age, gender, and race/ethnicity were included as covariates. A full-factorial Type 3 Sums of Squares model was used. Pairwise comparisons used a Bonferroni correction to adjust for multiple statistical tests.

Positive Affect. For positive affect, there was significant within-subjects interaction between positive affect and condition, $F(1, 104) = 4.86$, $p = .030$. Pairwise comparisons indicated that the difference between baseline and post-manipulation positive affect was only significant for participants in the rejection condition, *M* difference = -0.23, SE = 0.07, $p = .001$, [-0.36, -0.10]. For those in the rejection condition, positive affect was significantly lower after the manipulation ($M = 2.56$, SE = 0.11) than before the manipulation ($M = 2.78$, SE = 0.10). Although there was not a significant interaction effect overall, pairwise comparisons did show that this post-rejection effect only reached significance for those in the Cyberball manipulation, *M* difference = -0.30, SE = 0.10, $p = .003$, [-0.49, -0.10].

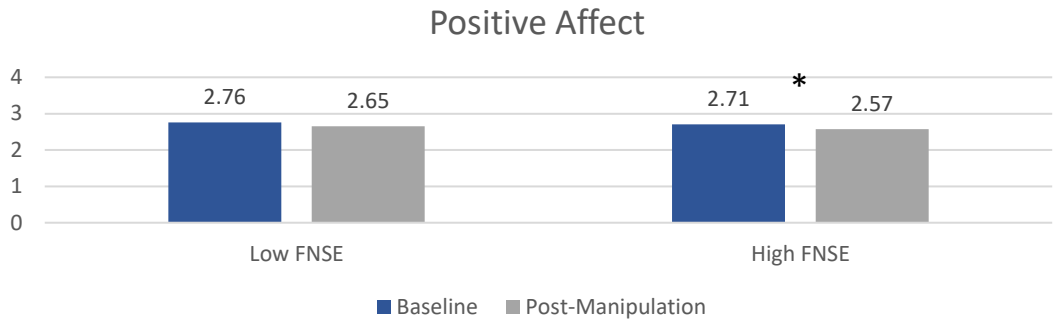


*Denotes a significant difference.
Figure 33. Positive Affect by Condition



*Denotes a significant difference.
Figure 34. Positive Affect by Manipulation, Rejection Condition

Pairwise comparison tests also indicated that there was only a significant decrease in positive affect among participants high in fear of negative social evaluation, *M* difference = -0.14, SE = 0.07, *p* = .034, [-0.27, -0.01].



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 35. Positive Affect by Fear of Negative Social Evaluation

Negative Affect. There were no significant within-subjects effects for negative affect, but the between-subjects effects for condition, $F(1, 104) = 7.28$, $p = .008$, manipulation, $F(1, 104) = 4.12$, $p = .045$, and fear of negative social evaluation, $F(1, 104) = 7.81$, $p = .006$, were all statistically significant.

Levels of negative affect were significantly higher among those who experienced rejection relative to acceptance at both baseline, *M* difference = 0.14, SE = 0.07, $p = .031$, [0.013, 0.27], $F(1, 104) = 4.78$, $p = .031$, and post-manipulation, *M* difference = -0.25, SE = 0.10, $p = .021$, [-0.45, -0.04], $F(1, 104) = 5.50$, $p = .021$. For participants who experienced acceptance, there was relatively no difference in negative affect between than pre-manipulation ($M = 1.31$, SE = 0.04) and post-manipulation ($M = 1.28$, SE = 0.07), whereas for participants who experienced rejection, negative affect was slightly higher post-manipulation ($M = 1.53$, SE = 0.07) than pre-manipulation ($M = 1.44$, SE = 0.05), but the pre-to-post-manipulation change was not statistically significant.

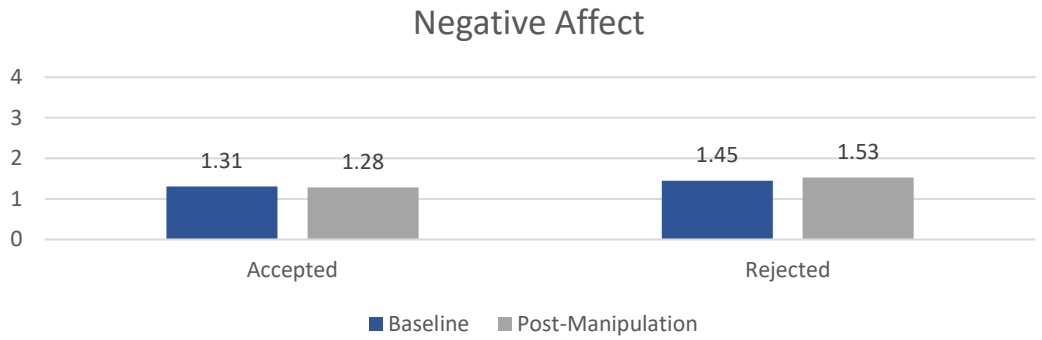
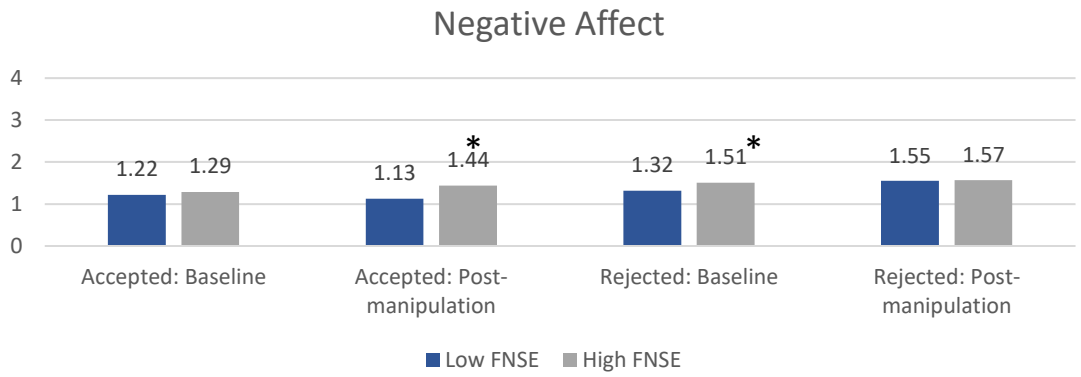


Figure 36. Negative Affect by Condition

Pairwise comparisons indicated that in the acceptance condition, negative affect was higher among participants high in fear of negative social evaluation only post-manipulation, *M* difference = 0.31, SE = 0.14, *p* = .035, [0.02, 0.60], *F*(1, 104) = 4.63, *p* =.034, but in the rejection condition, this difference was significant only at baseline, *M* difference = 0.26, SE = 0.09, *p* = .007, [0.73, 0.44], *F*(1, 104) = 7.66, *p* =.007.

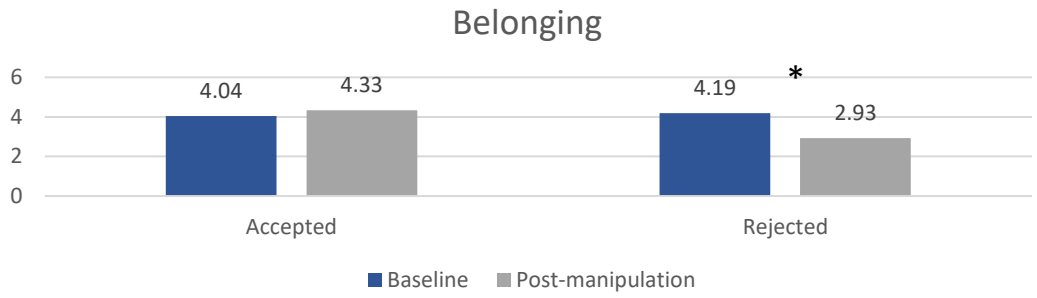


Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 37. Negative Affect by Fear of Negative Social Evaluation, by Condition

Belonging. There was a significant within-subject effect for belonging, $F(1, 108) = 5.04$, $p = .027$, as well as interactions between belonging and condition (acceptance or rejection), $F(1, 108) = 116.89$, $p < .001$, between belonging and manipulation (Future Life or Cyberball), $F(1, 108) = 36.85$, $p < .001$, and among belonging, condition, and manipulation, $F(1, 108) = 6.80$, $p = .010$, at the within-subject level. The interaction between belonging and fear of negative social evaluation was approached significance at the within-subject level as well, $F(1, 108) = 3.36$, $p = .070$. There were also significant between-subject effects for condition, $F(1, 108) = 42.25$, $p < .001$, manipulation, $F(1, 108) = 12.42$, $p = .001$, fear of negative social evaluation, $F(1, 108) = 9.40$, $p = .003$, and the condition by manipulation interaction, $F(1, 108) = 3.88$, $p = .050$.

Overall, perceptions of belonging decreased significantly from baseline to post-manipulation measurement, *M* difference = -0.48, SE = 0.07, $p < .001$, [0.34, 0.62], but pairwise comparisons by condition indicate that there was only a decline in belonging in the rejection condition, *M* difference = -1.26, SE = 0.10, $p = .007$, [-1.06, -1.46], whereas there was a statistically significant increase in belonging in the acceptance condition, *M* difference = 0.29, SE = 0.10, $p = .003$, [0.50, 0.10]. Furthermore, there was only a significant difference between feelings of belonging between participants in the acceptance versus rejection conditions *after* the manipulation, *M* difference = 1.41, SE = 0.14, $p < .001$, [1.13, 1.68], $F(1, 108) = 102.86$, $p < .001$.



*Denotes a significant difference.

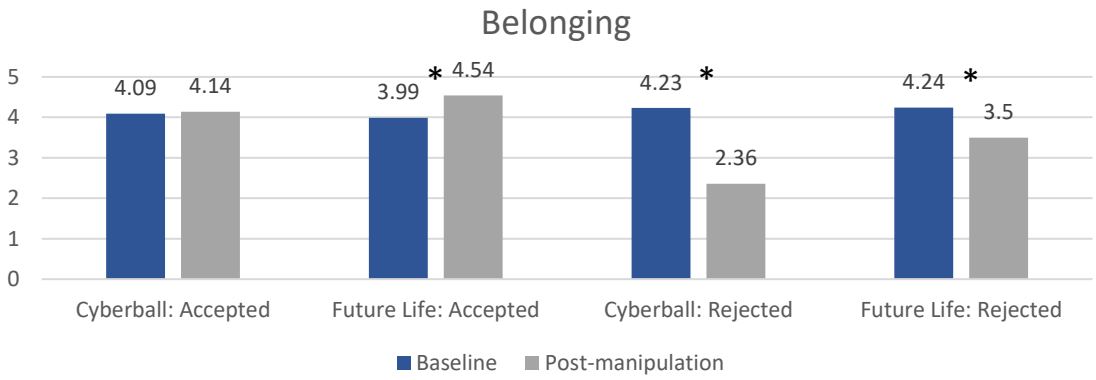
Figure 38. Belonging by Condition

Pairwise analyses by manipulation also indicated that there was only a significant difference in levels of belonging between participants in the Future Life versus Cyberball paradigms following the manipulation, *M* difference = 0.77, SE = 0.14, $p < .001$, [0.50, 1.04], $F(1, 108) = 31.43$, $p < .001$. Post-manipulation levels of belonging were higher among participants in the Future Life manipulation ($M = 4.02$, SE = 0.09) than participants in the Cyberball manipulation ($M = 3.25$, SE = 0.10). Additionally, there was a statistically significant decrease pre- to post-manipulation in feelings of belonging for participants in the Cyberball manipulation only, *M* difference = -0.91, SE = 0.10, $p < .001$, [-1.11, -0.71].

Differences in feelings of belonging were only significantly different between rejected and accepted participants post-manipulation for both Cyberball, *M* difference = 1.78, SE = 0.20, $p < .001$, [1.38, 2.17], $F(1, 108) = 80.14$, $p < .001$, and Future Life participants, *M* difference = 1.04, SE = 0.19, $p < .001$, [0.66, 1.41], $F(1, 108) = 30.21$, $p < .001$. In both manipulations, levels of belonging following the manipulation were higher among accepted participants than rejected participants. Likewise, the difference in feelings of belonging between Cyberball and Future Life participants was also only

significant post-manipulation in both the acceptance, *M* difference = 0.40, SE = 0.19, $p <$ .001, [0.02, 0.77], and rejection conditions, *M* difference = 1.14, SE = 0.20, $p <$ .001, [0.75, 1.52].

Experiencing rejection was associated with a significant decrease in feelings of belonging pre- to post-manipulation for both Cyberball, *M* difference = -1.87, SE = 0.15, $p <$ .001, [-1.58, -2.16], and Future Life participants, *M* difference = -0.64, SE = 0.14, $p <$ .001, [-0.92, -0.37]. Although levels of belonging increased for all participants who experienced acceptance, there was only a statistically significant effect for participants who experienced acceptance in the Future Life manipulation, *M* difference = 0.55, SE = 0.14, $p <$ .001, [0.28, 0.82].



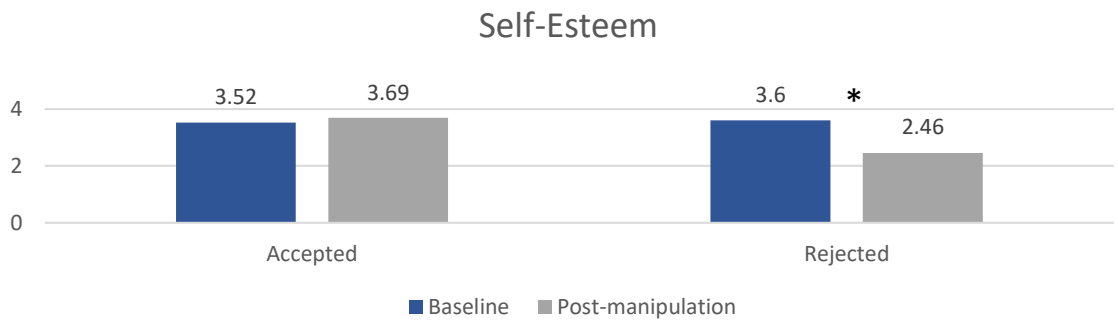
*Denotes a significant difference.

Figure 39. Belonging, Condition x Manipulation

Self-Esteem. Tests of within-subjects contrasts for self-esteem indicated significant interactions between self-esteem and condition, $F(1, 108) = 96.82$, $p <$ .001, manipulation, $F(1, 108) = 8.73$, $p = .004$, and fear of negative social evaluation, $F(1, 108) = 4.19$, $p = .043$. There was also a significant three-way interaction among self-esteem,

manipulation, and fear of negative social evaluation, $F(1, 108) = 4.62$, $p = .034$. There were also significant between-subjects effects for condition, $F(1, 108) = 22.63$, $p < .001$, and fear of negative social evaluation, $F(1, 108) = 16.99$, $p < .001$.

Once again, pairwise comparisons indicated that levels of self-esteem were not significantly different between participants in the acceptance and rejection conditions at baseline, but were significantly different following the manipulation, *M* difference = 1.23, SE = 0.15, $p < .001$, [0.94, 1.53], $F(1, 108) = 68.17$, $p < .001$, with levels of self-esteem higher among those who experienced acceptance ($M = 3.69$, SE = 0.10) compared to those who experienced rejection ($M = 2.46$, SE = 0.11). For rejected participants, there was a significant decrease in self-esteem pre- versus post-manipulation, *M* difference = -1.15, SE = 0.10, $p < .001$, [0.96, 1.33]. For accepted participants, there was an increase in self-esteem pre- versus post-manipulation that approached significance, *M* difference = 0.17, SE = 0.09, $p = .062$, [-0.01, 0.36].

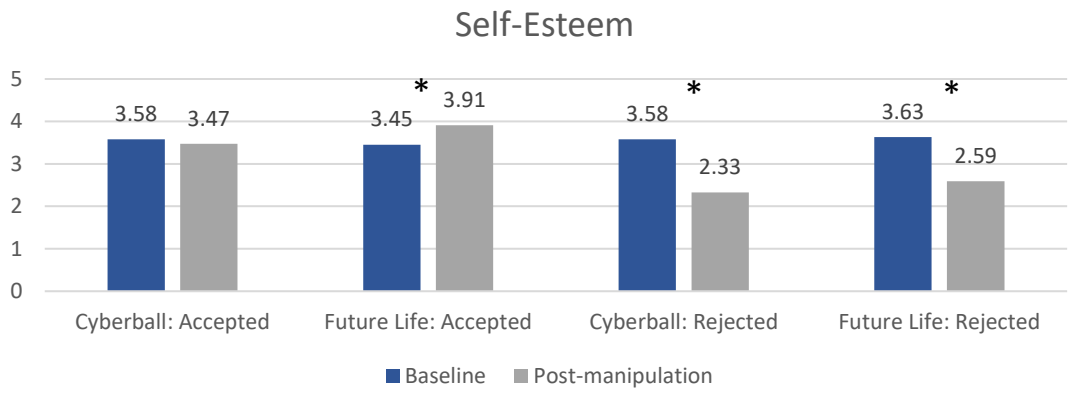


*Denotes a significant difference.

Figure 40. Self-Esteem by Condition

The pre-to-post-manipulation decrease in self-esteem among rejected participants was significant among participants in both the Cyberball, *M* difference = -1.25, SE =

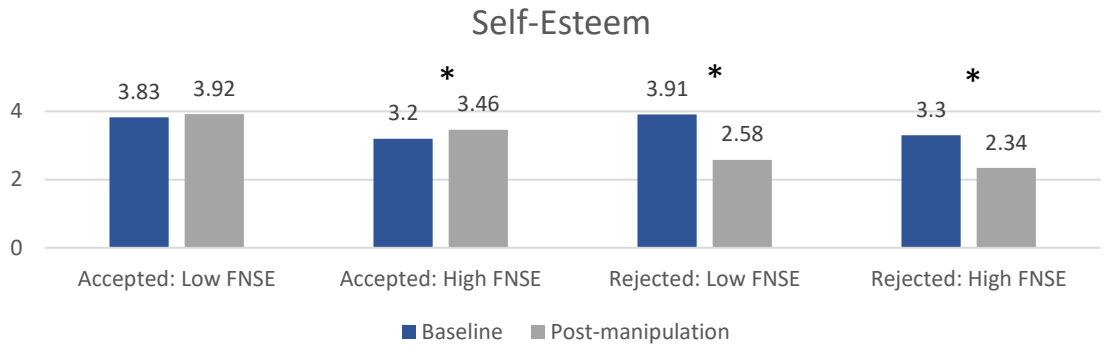
0.14, $p < .001$, [-1.52, -0.98], and Future Life manipulations, *M* difference = -1.04, SE = 0.13, $p < .001$, [-1.30, -0.78]. However, there was a statistically significant increase in self-esteem only among participants who experienced acceptance in the Future Life manipulation, *M* difference = 0.46, SE = 0.13, $p = .001$, [0.21, 0.71].



*Denotes a significant difference.

Figure 41. Self-Esteem, Condition x Manipulation

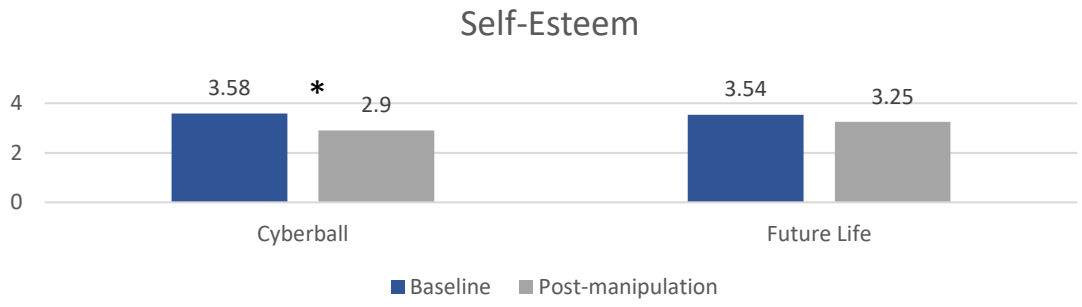
Although levels of self-esteem exhibited a significant pre-to-post-manipulation decline among participants who experienced rejection regardless of whether they were low, *M* difference = -1.33, SE = 0.14, $p < .001$, [-1.61, -1.05] or high, *M* difference = -0.96, SE = 0.13, $p < .001$, [-1.22, -0.71], in fear of negative social evaluation, the increase in self-esteem pre-to-post-manipulation among those who experienced acceptance was only statistically significant among those high in fear of negative social evaluation, *M* difference = 0.26, SE = 0.13, $p = .050$, [0.001, 0.52].



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 42. Self-Esteem by Fear of Negative Social Evaluation, by Condition

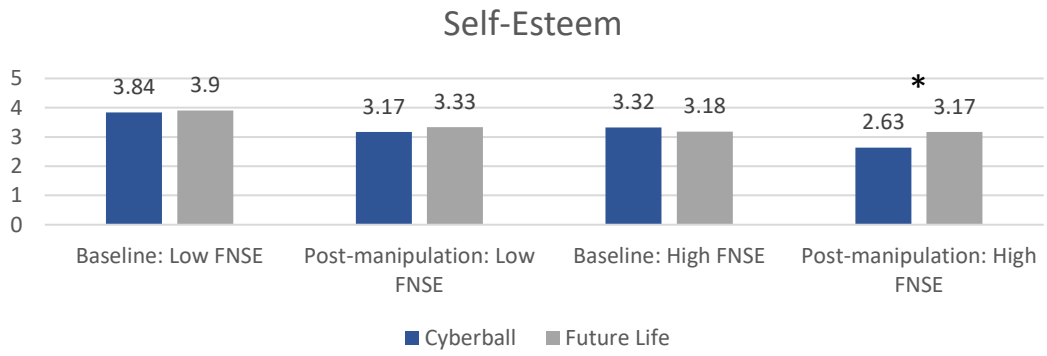
Levels of self-esteem were not significantly different between Future Life and Cyberball participants at baseline, but were significantly different following the manipulation, *M* difference = 0.35, SE = 0.15, $p = .019$, [0.06, 0.64], $F(1,108) = 5.63$, $p = .019$, with levels of self-esteem higher among those in the Future Life manipulation ($M = 3.25$, SE = 0.10) compared to those in the Cyberball manipulation ($M = 2.90$, SE = 0.11). However, there was a statistically significant decrease in feelings of self-esteem pre- to post-manipulation among participants in both the Cyberball, *M* difference = -0.68, SE = 0.10, $p < .001$, [-0.87, -0.49], and Future Life manipulations, *M* difference = -0.29, SE = 0.09, $p = .002$, [-0.47, -0.11].



*Denotes a significant difference.

Figure 43. Self-Esteem by Manipulation

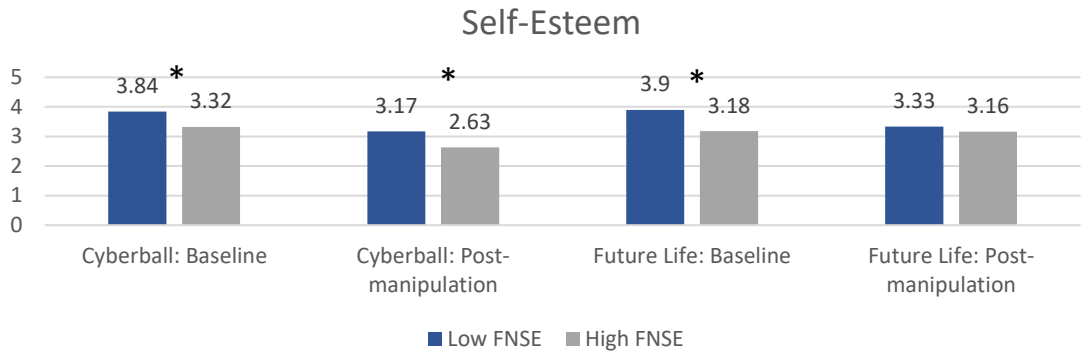
Furthermore, the difference in self-esteem between Future Life and Cyberball participants was only statistically significant post-manipulation for participants high in fear of negative social evaluation, *M* difference = 0.54, SE = 0.21, *p* = .010, [0.14, 0.95], *F*(1, 108) = 6.97, *p* = .010. For participants high in fear of negative social evaluation, levels of self-esteem were significantly higher among those in the Future Life manipulation (*M* = 3.17, SE = 0.14) compared to those in the Cyberball manipulation (*M* = 2.63, SE = 0.15) post-manipulation.



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 44. Self-Esteem by Fear of Negative Social Evaluation, by Manipulation

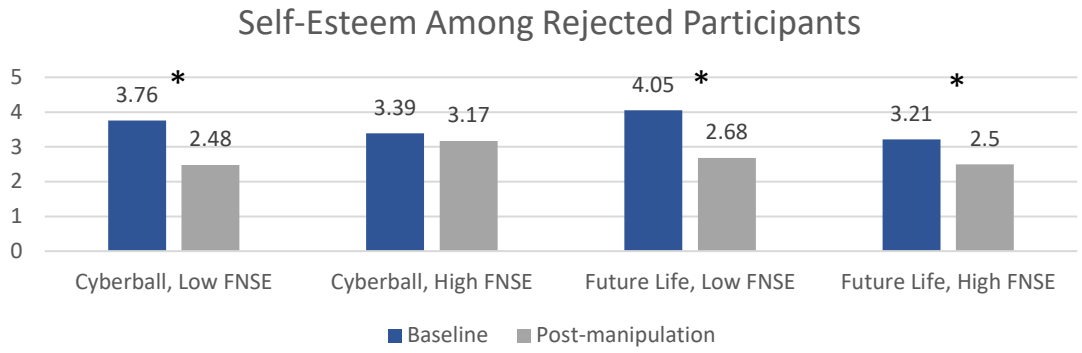
Among Cyberball participants, those high in fear of negative social evaluation reported lower levels of self-esteem at baseline, *M* difference = -0.52, SE = 0.18, *p* = .004, [-0.88, -0.17], and post-manipulation, *M* difference = -0.54, SE = 0.21, *p* = .012, [-0.97, -0.12]. Among Future Life participants, those high in fear of negative social evaluation also reported lower levels of self-esteem, but this difference was only significant at baseline, *M* difference = -0.72, SE = 0.17, *p* < .001, [-1.06, -0.38].



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

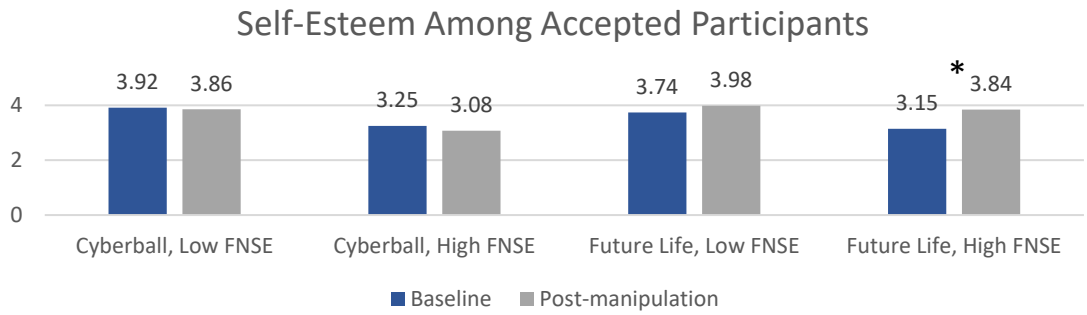
Figure 45. Self-Esteem by Fear of Negative Social Evaluation, by Manipulation

There was a statistically significant drop in self-reported self-esteem pre-to-post-manipulation for Cyberball participants regardless of levels of fear of negative social evaluation, but for future life, the decline was only significant among those low in fear of negative social evaluation, *M* difference = -0.57, SE = 0.13, $p < .001$, [-0.83, -0.31]. However, this pattern is qualified by the three-way interaction among self-esteem, manipulation, and condition. Specifically, all participants who experienced social rejection evidenced a statistically significant decrease in self-esteem between baseline and post-manipulation measurements regardless of the manipulation they experienced or their level of fear of negative social evaluation, but for participants who experienced social acceptance, there was only a statistically significant change in levels of self-esteem for those who were high in fear of negative social evaluation who experienced acceptance in the Future Life manipulation, *M* difference = 0.68, SE = 0.19, $p = .001$, [0.30, 1.06]. For these participants, there was a significant increase in self-reported self-esteem from baseline ($M = 3.15$, SE = 0.18) to post-manipulation ($M = 3.84$, SE = 0.21).



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 46. Self-Esteem by Fear of Negative Social Evaluation, By Manipulation, Acceptance Condition

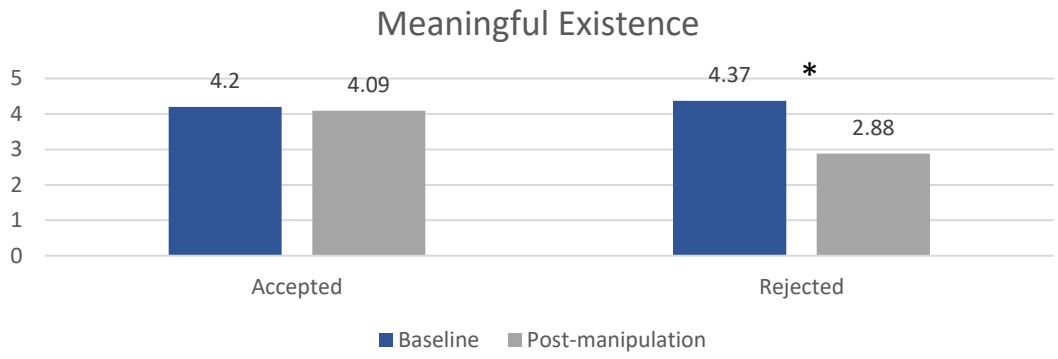


Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 47. Self-Esteem by Fear of Negative Social Evaluation, By Manipulation, Acceptance Condition

Meaningful Existence. For meaningful existence, there were significant within-subjects interactions between meaningful existence and condition, $F(1,108) = 84.89$, $p < .001$, manipulation, $F(1,108) = 39.51$, $p < .001$, and fear of negative social evaluation, $F(1,108) = 3.89$, $p = .050$, as well as a significant interaction among meaningful existence, condition, and manipulation, $F(1,108) = 8.22$, $p = .005$. The effects of condition, $F(1,108) = 33.34$, $p < .001$, manipulation, $F(1,108) = 23.18$, $p < .001$, fear of negative social evaluation, $F(1,108) = 5.99$, $p = .016$, and the condition by manipulation interaction, $F(1,108) = 5.14$, $p = .025$, were also significant at the within-subjects level.

Levels of meaningful existence were only significantly difference between rejected and accepted participants post-manipulation, *M* difference = 1.21, SE = 0.14, $p <$ .001, [0.93, 1.49], $F(1,108) = 73.50$, $p < .001$; post-manipulation, self-reported feelings of meaningful existence were higher among accepted participants ($M = 4.09$, SE = 0.10) than among rejected participants ($M = 2.88$, SE = 0.10). Additionally, there was only a statistically significant change in feelings of meaningful existence pre-to-post-manipulation for participants who experienced rejection, *M* difference = -1.49, SE = 0.11, $p <$ .001, [-1.70, -1.28]. Rejected participants exhibited a decline in feelings of meaningful existence post-rejection ($M = 2.88$, SE = 0.10) relative to baseline ($M = 4.37$, SE = 0.06).

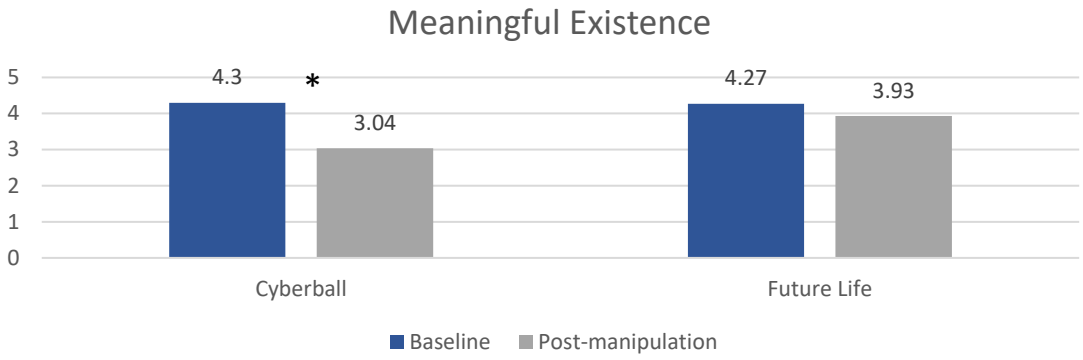


*Denotes a significant difference.

Figure 48. Meaningful Existence by Condition

A decline in feelings of meaningful existence pre-to-post-manipulation was evident for both Cyberball, *M* difference = -1.26, SE = 0.11, $p <$ .001, [-1.47, -1.06], and Future Life participants, *M* difference = -0.38, SE = 0.10, $p = .001$, [-0.54, -0.14], and levels of meaningful existence were only significantly different among Cyberball and Future Life participants following the manipulation, *M* difference = 0.89, SE = 0.14, $p <$

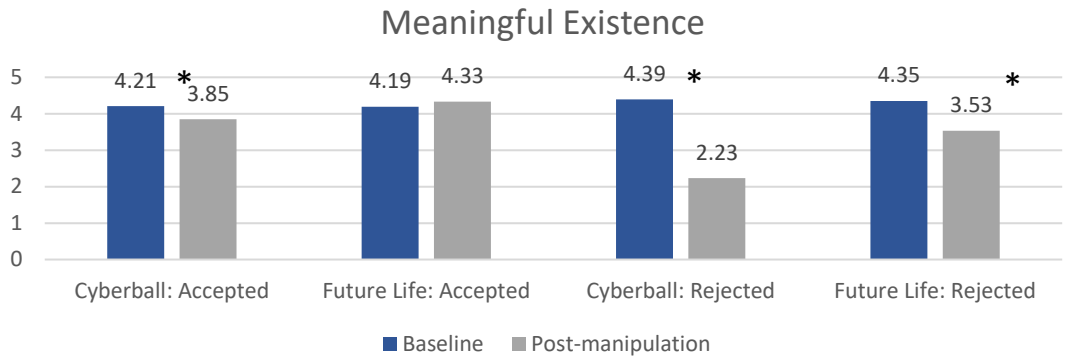
.001, [0.62, 1.17], $F(1,108) = 41.09$, $p < .001$. Post-manipulation, Future Life participants reported higher levels of meaningful existence ($M = 3.93$, SE = 0.10) compared to Cyberball participants ($M = 3.04$, SE = 0.10).



*Denotes a significant difference.

Figure 49. Meaningful Existence by Manipulation

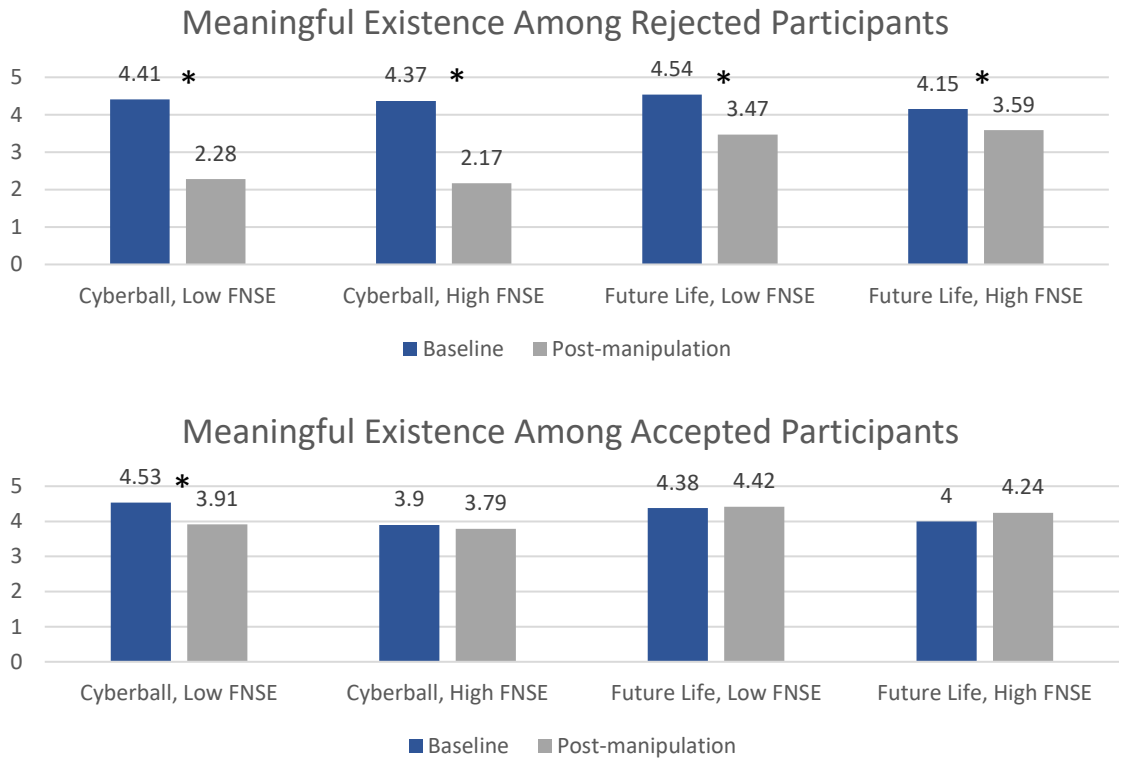
These differences are qualified by an interaction between condition and manipulation. That is, while there was a significant decrease in feelings of meaningful existence post-rejection for both the Cyberball, *M* difference = -2.16, SE = 0.15, $p < .001$, [-2.46, -1.86], and Future Life manipulation groups, *M* difference = -0.82, SE = 0.15, $p < .001$, [-1.10, -0.53], the patterns of pre-to-post-manipulation change differed considerably among those in the acceptance groups. Among participants in the Cyberball manipulation, levels of meaningful existence were significantly lower post-manipulation than at baseline, *M* difference =- 0.37, SE = 0.15, $p = .014$, [-0.66, -0.08]. In contrast, for those who experienced acceptance in the Future Life manipulation, levels of meaningful existence were higher post-manipulation ($M = 4.33$, SE = 0.14) than at baseline ($M = 4.19$, SE = SE = 0.08), although the difference failed to reach significance.



*Denotes a significant difference.

Figure 50. Meaningful Existence, Condition x Manipulation

Participants high in fear of negative social evaluation reported lower levels of meaningful existence than participants low in fear of negative social evaluation, but this difference was only significant at baseline, *M* difference = -0.36, SE = 0.09, $p < .001$, [-0.53, -0.19], $F(1,108) = 17.90$, $p < .001$. All participants who experienced social rejection reported lower levels of meaningful existence following the manipulation relative to baseline, regardless of manipulation or levels of fear of negative social evaluation. Among participants who experienced acceptance, those in the Cyberball manipulation also reported lower levels of meaningful existence following the manipulation, but this effect was only significant among those low in fear of negative social evaluation, *M* difference = -0.63, SE = 0.22, $p = .005$, [0.19, 1.06].



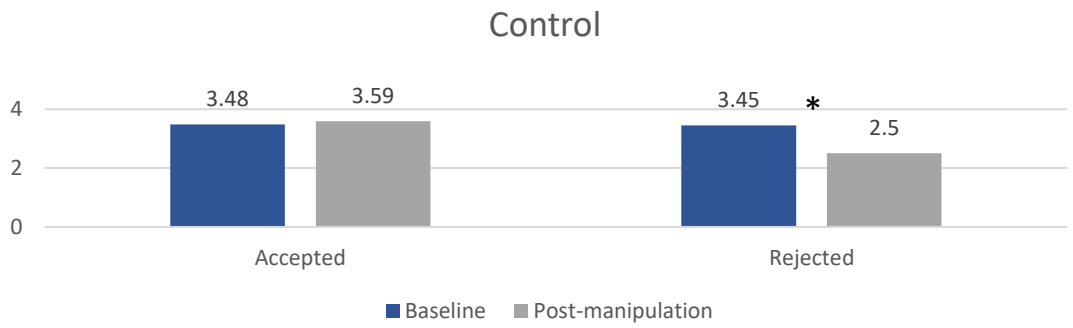
Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 51. Meaningful Existence by Fear of Negative Social Evaluation, by Manipulation

Control. There were also significant within-subject interactions for feelings of control with condition, $F(1,108) = 43.61$, $p < .001$, manipulation, $F(1,108) = 31.20$, $p < .001$, and fear of negative social evaluation, $F(1,108) = 4.12$, $p = .045$, as well as a significant three-way interaction among control, condition, and manipulation. The between-subjects effects for condition, $F(1,108) = 25.28$, $p < .001$, manipulation, $F(1,108) = 6.99$, $p = .009$, and fear of negative social evaluation, $F(1,108) = 6.20$, $p = .014$, were also significant.

Overall, there was a significant change in self-reported feelings of control among participants who experienced rejection, *M* difference = -0.96, SE = 0.11, $p < .001$, [-1.18,

-0.73], but not among those who experienced acceptance. For participants who experienced rejection, feelings of control were lower following the rejection experience (M = 2.50, SE = 0.10) relative to baseline (M = 3.45, SE = 0.09). Self-reported feelings of control were significantly higher among participants who experienced acceptance (M = 3.59, SE = 0.10) compared to those who experienced rejection (M = 2.50, SE = 0.10), following the manipulation, M difference = 1.09, SE = 0.15, $p < .001$, [0.80, 1.38], $F(1,108) = 55.76$, $p < .001$, but not at baseline.

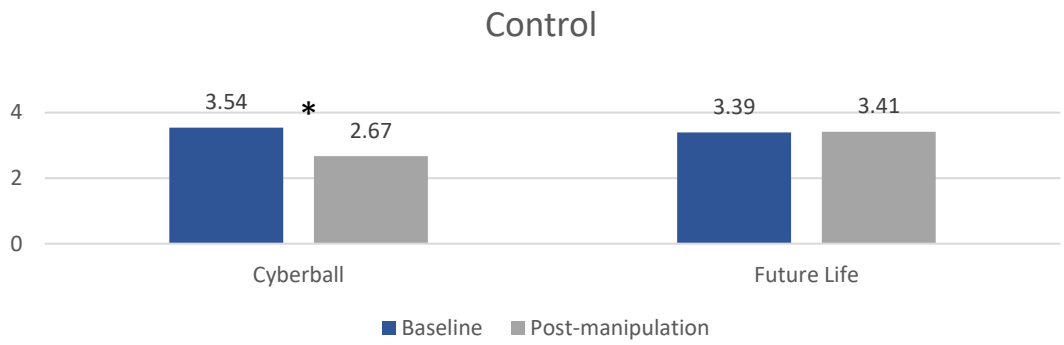


*Denotes a significant difference.

Figure 52. Control by Condition

Similarly, self-reported feelings of control were significantly different among respondents in the Cyberball versus Future Life manipulation, but only following the manipulation, M difference = 0.73, SE = 0.14, $p < .001$, [0.45, 1.02], $F(1,108) = 25.85$, $p < .001$, with participants in the Future Life manipulation reporting higher levels of control post-manipulation (M = 3.41, SE = 0.10) compared to participants in the Cyberball manipulation (M = 2.67, SE = 0.10). Cyberball participants evidenced a statistically significant decrease in feelings of control pre-to-post-manipulation, M

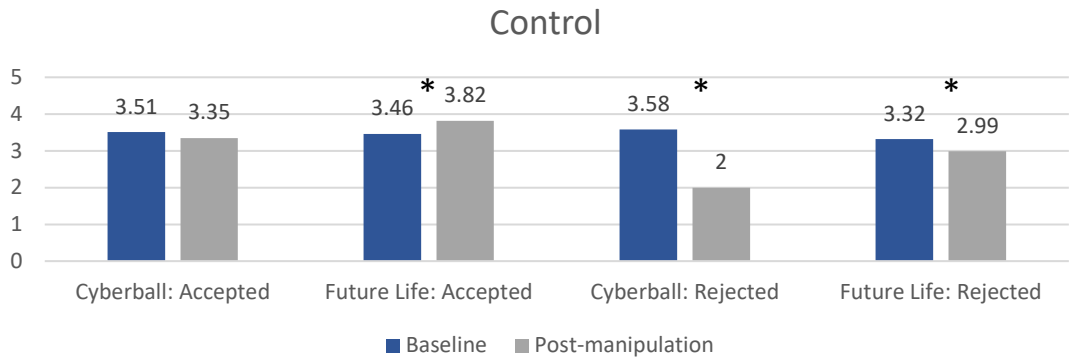
difference = -0.87, SE = 0.11, $p < .001$, [-1.09, -0.64], whereas there was not a statistically significant change in feelings of control for Future Life participants.



*Denotes a significant difference.

Figure 53. Control by Manipulation

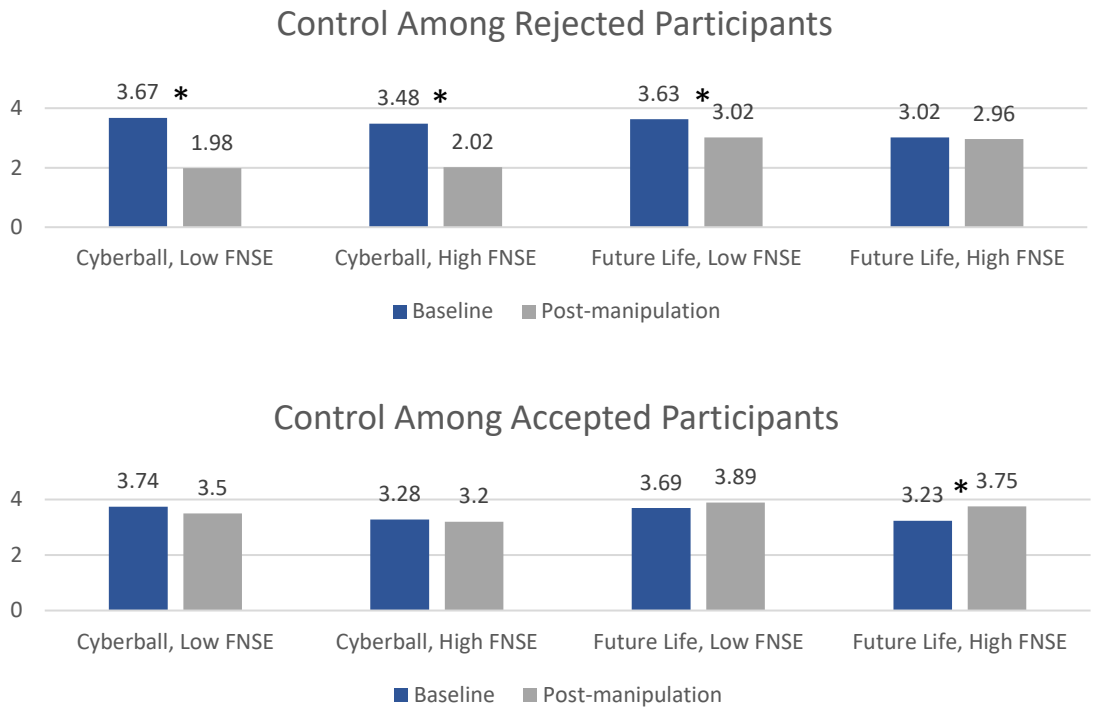
However, the three-way interaction among control, condition, and manipulation showed that while there was a significant decrease in feelings of control post-rejection relative to baseline for participants in both the Cyberball, *M* difference = -1.58, SE = 0.16, $p < .001$, [-1.90, -1.25], and Future Life manipulations, *M* difference = -0.33, SE = 0.16, $p = .036$, [-0.64, -0.02], the patterns of change in feelings of control differed between the Cyberball and Future Life manipulations among those who experienced acceptance. Specifically, those who experienced acceptance in the Future Life manipulation exhibited a significant increase in feelings of control post-manipulation relative to baseline, *M* difference = 0.37, SE = 0.15, $p = .019$, [0.06, 0.67], but those who experienced acceptance in the Cyberball manipulation did not.



*Denotes a significant difference.

Figure 54. Control by Condition x Manipulation

Participants high in fear of negative social evaluation reported lower levels of control needs satisfaction than those low in fear of negative social evaluation, but the difference was only significant at baseline, *M* difference = -0.43, SE = 0.13, *p* = .001, [-0.68, -0.18]. However, pairwise comparisons indicated that among participants who were rejected, there was a significant pre-to-post-manipulation decrease in feelings of control for all participants who experienced rejection in the Cyberball manipulation, but only for participants low in fear of negative social evaluation for those who experienced rejection in the Future Life manipulation, *M* difference = -0.61, SE = 0.24, *p* = .013, [-1.08, -0.13]. Yet, among participants who experienced acceptance, there was only a significant change in feelings of control between baseline and post-manipulation measurements among those who experienced acceptance in the Future Life manipulation, and only for those high (but not low) in fear of negative social evaluation, *M* difference = 0.52, SE = 0.23, *p* = .024, [0.07, 0.97]; participants high in fear of negative social evaluation reported higher levels of control after experiencing acceptance in the Future Life manipulation (*M* = 3.75, SE = 0.21) relative to baseline (*M* = 3.23, SE = 0.18).



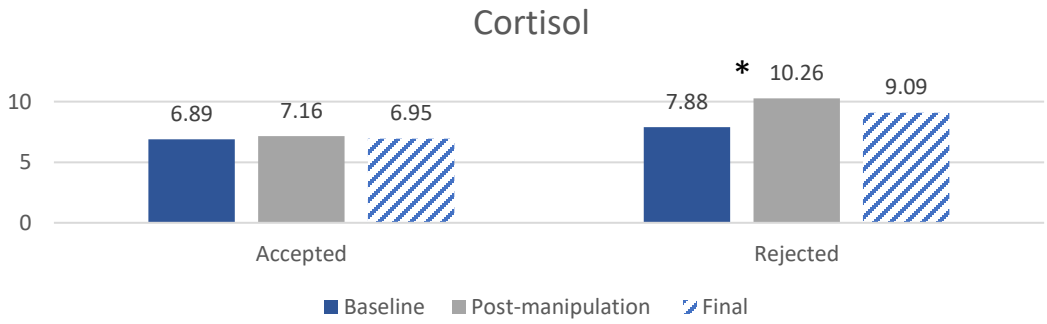
Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 55. Control by Fear of Negative Social Evaluation by Condition x Manipulation

Cortisol. There was a significant within-subjects interaction among cortisol, condition, and manipulation, $F(1, 102) = 5.96$, $p = .016$, indicating a significant linear trend. (Note that initial repeated measures GLMs, without fear of negative social evaluation or covariates included, had indicated a significant quadratic trend, but not a significant linear trend.) There were no statistically significant between-subjects effects for cortisol in this model.

Pairwise comparisons indicated that the difference in cortisol levels between accepted and rejected participants was approaching statistically significant at the post-manipulation measurement (Sample 2) only, *M* difference = 3.10, SE = 1.56, $p = 0.052$, [-

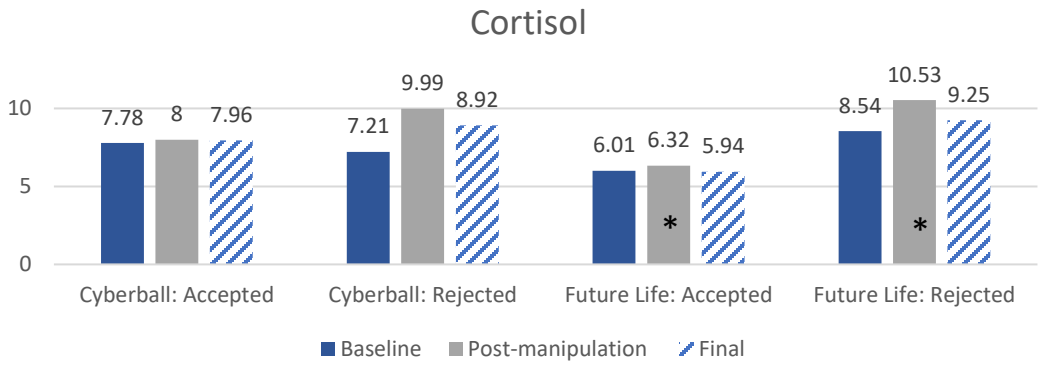
0.03, 6.23], $F(1, 102) = 3.86$, $p = .052$, with higher post-manipulation cortisol levels among participants who experienced rejection ($M = 10.26$, SE = 1.11) compared to participants who experienced acceptance ($M = 7.16$, SE = 1.04). Furthermore, only participants who experienced rejection exhibited a significant increase in cortisol levels post-manipulation relative to baseline, M difference = 2.38, SE = 0.84, $p = 0.016$, [0.34, 4.23]. There was not a statistically significant change in cortisol between the post-manipulation measurement (Sample 2) and final measurement (Sample 3) for either group.



*Denotes a significant difference.

Figure 56. Cortisol Levels by Condition

When taking into account the manipulation paradigm, the difference in post-manipulation (Sample 2) cortisol levels between accepted and rejected participants was only statistically significant among participants in the Future Life manipulation, M difference = 4.21, SE = 2.10, $p = 0.048$, [0.04, 8.38], $F(1,102) = 4.01$, $p = .048$.



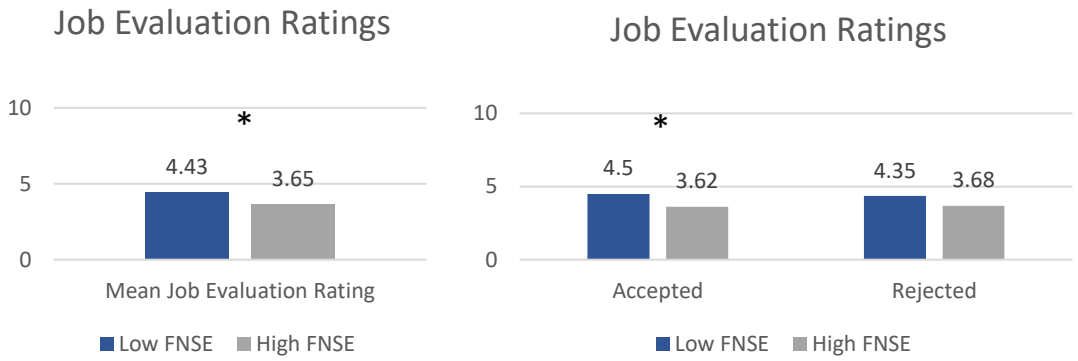
*Denotes a significant difference.

Figure 57. Cortisol Levels Condition x Manipulation

Job Evaluation Ratings. Because job evaluation ratings were measured only once at the end of the experiment, there were no within-subjects effects to test. Between-subjects contrasts tests indicated no significant effects of condition, manipulation, of fear of negative social evaluation on job evaluation ratings. Overall, ratings were similar between accepted (M = 4.06, SE = 0.21) and rejected (M = 4.01, SE = 0.22) participants. Job evaluation ratings were slightly lower among participants who experienced rejection in the Cyberball manipulation (M = 3.71, SE = 0.31) compared to the Future Life manipulation (M = 4.32, SE = 0.31), but the difference was not statistically significant. Interestingly, for participants in all experimental groups, mean job evaluation ratings were below the scale midpoint (5), indicating that, on the whole, participants provided job evaluations that were not very positive.

Although there was no a significant overall effect of fear of negative social evaluation on job evaluation ratings, it is worth noting that pairwise comparison tests did

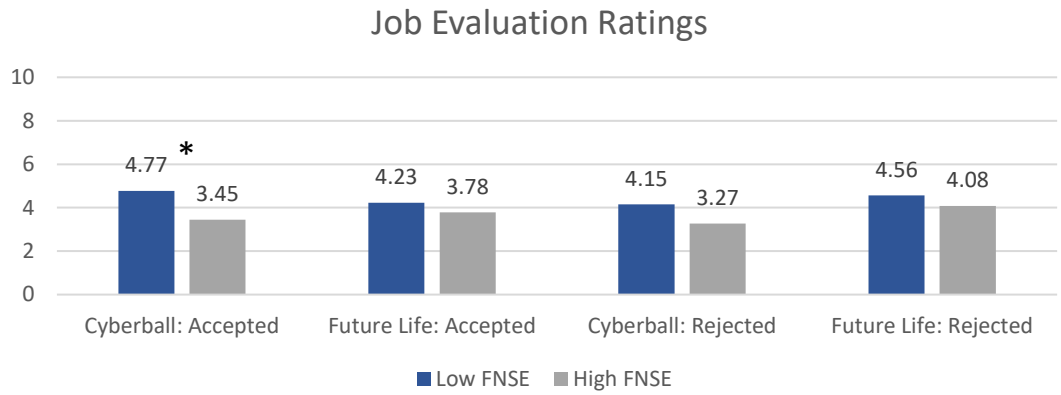
reveal that participants high in fear of negative social evaluation provided significantly lower job evaluation ratings than those low in fear of negative social evaluation, *M* difference = -0.78, SE = 0.30, *p* = 0.011, [-1.37, -0.18], *F*(1, 103) = 6.71, *p* = .011. This difference was apparent among participants whether they experienced rejection or acceptance, but only reached significance among those who experienced acceptance, *M* difference = -0.88, SE = 0.43, *p* = 0.041, [-1.73, -0.04], *F*(1, 103) = 4.30, *p* = .041.



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.

Figure 58. Jon Evaluation Ratings by Fear of Negative Social Evaluation

When assessing differences by manipulation type, the difference in job evaluation ratings among those high versus low in fear of negative social evaluation showed the same pattern in all experimental groups, but was only statistically significant among those who experienced acceptance in the Cyberball manipulation, *M* difference = -1.32, SE = 0.61, *p* = 0.033, [-2.54, -0.11], *F*(1, 103) = 4.69, *p* = .033.



Note. FNSE = Fear of Negative Social Evaluation. *Denotes a significant difference.
Figure 59. Jon Evaluation Ratings by Fear of Negative Social Evaluation

Follow-Up Analyses: Hierarchical Regressions of Interrelated Responses

Because it was not possible to create a Level 1 structural equation model modeling change-over-time in cortisol, affect, and basic needs satisfaction simultaneously, hierarchical regressions were used to assess the interrelations of these measures. All hierarchical regressions were run separately by condition and manipulation to evaluate different patterns of effects across experimental conditions.

Post-Manipulation Cortisol. To understand how affect and dimensions of basic needs satisfaction were associated with cortisol changes during the experiment, hierarchical regressions were conducted in which post-manipulation (Sample 2) cortisol served as the dependent variables. To control for baseline cortisol, initial cortisol levels (Sample 1) were added in the first block. For all regressions, the baseline measure of affect or needs, respectively, was added in the second block, with the post-manipulation measure of affect or needs, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in affect or needs, above and beyond baseline levels, predicted changes in cortisol post-manipulation, controlling for baseline cortisol levels.

Post-manipulation positive affect did not significantly predict post-manipulation cortisol levels, controlling for baseline levels of positive affect and cortisol. There were also no significant effects of baseline positive affect on post-manipulation cortisol, controlling for baseline cortisol. However, post-manipulation negative affect was a significant predictor of post-manipulation cortisol, controlling for baseline levels of cortisol and negative affect, $\beta = .51$, $t = 2.26$, $p = .034$, but only among participants who experienced acceptance in the Cyberball manipulation. For these participants, higher levels of negative affect following the manipulation were associated with higher levels of cortisol following the manipulation. Baseline negative affect, however, was not significantly associated with post-manipulation cortisol levels for any of the experimental groups. The full regression model was significant, $F(3,22) = 14.70$, $p < .001$, $R^2 = .67$, and accounted for 67% of the variance in post-manipulation cortisol levels. The addition of post-manipulation negative affect accounted for an additional 8% of the variance in post-manipulation cortisol, above and beyond baseline cortisol and negative affect, $\Delta F(1,22) = 5.11$, $p = .034$, $\Delta R^2 = .08$. None of the basic needs satisfaction measures significantly predicted post-manipulation cortisol either at baseline or post-manipulation.

Final Cortisol Levels. Additional hierarchical regression models were conducted to understand how affect and dimensions of basic needs satisfaction were associated with cortisol changes during the experiment, use the final cortisol levels (Sample 3) as the dependent variable. To control for baseline cortisol (Sample 1) and post-manipulation (Sample 2), the two prior cortisol measurements were added in the first block. For all regressions, the baseline measure of affect or needs, respectively, was added in the

second block, with the post-manipulation measure of affect or needs, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in affect or needs, above and beyond baseline levels, predicted final cortisol levels, controlling for baseline and post-manipulation cortisol levels.

Post-manipulation positive affect did not significantly predict final cortisol levels, controlling for baseline levels of positive affect and cortisol and post-manipulation cortisol. There were also no significant effects of baseline positive affect on final cortisol, controlling for prior cortisol measurements. However, yet again, post-manipulation negative affect was a significant predictor of final cortisol levels, controlling for baseline levels of cortisol and negative affect and post-manipulation cortisol. This effect was significant for participants who experienced acceptance in Cyberball, $\beta = .84$, $t = 3.02$, $p = .007$, such that higher levels of negative affect following the manipulation were associated with higher levels of cortisol at the end of the experiment. Baseline negative affect was only significantly associated with final cortisol levels after post-manipulation negative affect was added to the model (third block), $\beta = -.59$, $t = -2.26$, $p = .036$, such that lower levels of negative affect at baseline were associated with higher levels of cortisol at the end of the study, controlling for prior cortisol measurements and post-manipulation negative affect. The full regression model was significant, $F(4,19) = 8.78$, $p < .001$, $R^2 = .65$, and accounted for 65% of the variance in final cortisol levels. The addition of post-manipulation negative affect accounted for an additional 17% of the variance in final cortisol levels, $\Delta F(1,19) = 9.10$, $p = .007$, $\Delta R^2 = .17$.

Post-manipulation negative affect was also a significant predictor of final cortisol levels, controlling for baseline levels of cortisol and negative affect and post-manipulation cortisol, among participants who experienced rejection in the Cyberball manipulation, $\beta = .22$, $t = 2.99$, $p = .008$, such that higher levels of negative affect following the manipulation were associated with higher levels of cortisol end of the experiment. Baseline negative affect was also significantly associated with final cortisol levels, both independently (block 2), $\beta = .18$, $t = 2.28$, $p = .034$, and after post-manipulation negative affect was added to the model (block 3), $\beta = .15$, $t = 2.12$, $p = .048$; higher levels of negative affect at baseline were associated with higher levels of cortisol at the end of the study, controlling for prior cortisol measurements and post-manipulation negative affect. The full regression model was significant, $F(4,18) = 50.37$, $p < .001$, $R^2 = .92$, and accounted for 92% of the variance in final cortisol levels. The addition of baseline negative affect (block 2) accounted for an additional 3% of the variance in final cortisol levels, $\Delta F(1,19) = 5.20$, $p = .034$, $\Delta R^2 = .03$, whereas post-manipulation negative affect accounted for an additional 4% of the variance in final cortisol levels, $\Delta F(1,18) = 8.91$, $p = .008$, $\Delta R^2 = .04$.

None of the basic needs satisfaction measures significantly predicted final cortisol levels when measured post-manipulation. However, baseline levels of self-esteem and meaningful existence did significantly predict final cortisol levels when controlling for prior cortisol measurements among some experimental groups.

Among participants who experienced rejection in the Future Life manipulation, those with lower levels of self-esteem at baseline exhibited higher levels of cortisol at the

end of the study, controlling for prior cortisol measurements, β = -.27, t = -2.15, p = .041. The model accounted for 60% of the variance in final cortisol levels, $F(3,27) = 15.57$, $p < .001$, $R^2 = .60$, with the addition of baseline self-esteem accounting for 7% unique variance in final cortisol levels, $\Delta F(1,27) = 4.61$, $p = .041$, $\Delta R^2 = .07$. However, the effect of baseline self-esteem on final cortisol become non-significant when controlling for post-manipulation self-esteem, β = -.23, t = -1.60, p = .123.

Baseline levels of meaningful existence predicted final cortisol levels for three of the experimental groups and had similar effects in all three. Among participants who experienced acceptance in the Cybeball manipulation, those with lower levels of meaningful existence at baseline exhibited higher levels of cortisol at the end of the study, controlling for prior cortisol measurements, β = -.35, t = -2.40, p = .025. This effect remained significant even when post-manipulation levels of meaningful existence were added to the model, β = -.36, t = -2.37, p = .028. The addition of baseline levels of meaningful existence accounted for an additional 11% of unique variance in final cortisol levels above and beyond prior cortisol measurements, $\Delta F(1,22) = 4.48$, $p = .025$, $\Delta R^2 = .11$, and resulted in a significant overall regression model, $F(3,22) = 10.29$, $p < .001$, $R^2 = .58$, that accounted for 58% of the variance in final cortisol altogether.

Among participants who experienced acceptance in the Future Life manipulation, there was a similar pattern, such that those with lower levels of meaningful existence at baseline exhibited higher levels of cortisol at the end of the study, controlling for prior cortisol measurements, β = -.16, t = -2.12, p = .044. This effect remained significant even when post-manipulation levels of meaningful existence were added to the model, β = -

.22, t = -2.60, p = .015. Although the addition of baseline levels of meaningful existence accounted for only an additional 2% of unique variance in final cortisol levels above and beyond prior cortisol measurements, it was a significant contribution to the model, $\Delta F(1,26) = 4.48$, $p = .044$, $\Delta R^2 = .02$, and resulted in a significant overall regression model, $F(3,26) = 57.54$, $p < .001$, $R^2 = .87$, that accounted for 87% of the variance in final cortisol altogether.

Finally, among participants who experienced rejection in the Future Life manipulation, those with lower levels of meaningful existence at baseline also exhibited higher levels of cortisol at the end of the study, controlling for prior cortisol measurements, β = -.29, t = -2.31, p = .029. This effect remained significant even when post-manipulation levels of meaningful existence were added to the model, β = -.28, t = -2.14, p = .042. The addition of baseline levels of meaningful existence accounted for an additional 8% of unique variance in final cortisol levels above and beyond prior cortisol measurements, $\Delta F(1,27) = 5.32$, $p = .029$, $\Delta R^2 = .08$, and resulted in a significant overall regression model, $F(3,27) = 13.76$, $p < .001$, $R^2 = .61$, that accounted for 61% of the variance in final cortisol altogether.

Post-Manipulation Positive Affect. To understand how cortisol and dimensions of basic needs satisfaction were associated with changes in positive affect during the experiment, hierarchical regressions were conducted using post-manipulation levels of positive affect as the dependent variable. To control for baseline positive affect, the initial measurement of positive affect was added in the first block. For all regressions, the baseline measure of cortisol or needs, respectively, was added in the second block, with

the post-manipulation measure of cortisol or needs, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in cortisol or needs, above and beyond baseline levels, predicted post-manipulation positive affect, controlling for baseline levels of all variables.

Among participants who experienced acceptance in the Cyberball manipulation, those with higher levels of cortisol at baseline exhibited higher levels of positive affect post-manipulation, controlling for baseline positive affect, $\beta = .25$, $t = 2.38$, $p = .026$. The model accounted for 76% of the variance in post-manipulation positive affect, $F(2,23) = 37.16$, $p < .001$, $R^2 = .76$, with the addition of baseline cortisol levels accounting for 6% unique variance in post-manipulation positive affect levels, $\Delta F(1,23) = 5.69$, $p = .026$, $\Delta R^2 = .06$. However, the effect of baseline cortisol on post-manipulation positive affect become non-significant when controlling for post-manipulation cortisol, $\beta = .17$, $t = 1.05$, $p = .305$.

Post-manipulation levels of belonging significantly predicted post-manipulation levels of positive affect, controlling for baseline levels of both, but only among participants who experienced rejection in the Future Life manipulation. For these participants, higher levels of belonging following the experience of rejection were associated with higher levels of positive affect following the manipulation, $\beta = .35$, $t = 2.68$, $p = .012$. Adding post-manipulation belonging to the model significantly improved the model, $\Delta F(1,27) = 7.21$, $p = .012$, $\Delta R^2 = .10$, and accounted for an additional 10% of the variance in post-manipulation positive affect above and beyond baseline measures. Levels of belonging measured at baseline did not significantly predict post-manipulation

positive affect when added independently (block 2), but did become significant after controlling for post-manipulation belonging (block 3), β = -.28, t = -2.13, p = .043, such that higher levels of belonging at baseline were associated with lower levels of positive affect post-manipulation, controlling for baseline positive affect and post-manipulation belonging. The full regression model was significant, $F(3,27) = 14.28$, $p < .001$, $R^2 = .61$, and accounted for 61% of the variance in post-manipulation positive affect altogether.

Self-reported self-esteem was also associated with changes in positive affect during the experiment. For participants who experienced rejection in the Cyberball manipulation, higher levels of post-manipulation self-esteem significantly predicted higher levels of positive affect following the experience of rejection, β = .52, t = 3.14, p = .005. Adding post-manipulation self-esteem to the model significantly improved the model, $\Delta F(1,21) = 9.87$, p = .005, R^2 = .15, and accounted for an additional 15% of the variance in post-manipulation positive affect above and beyond baseline measures. Levels of self-esteem measured at baseline did not significantly predict post-manipulation positive affect when added independently (block 2), but did become significant after controlling for post-manipulation self-esteem (block 3), β = -.39, t = -2.11, p = .047, such that higher levels of self-esteem at baseline were associated with lower levels of positive affect post-manipulation, controlling for baseline positive affect and post-manipulation self-esteem. The full regression model was significant, $F(3,21) = 15.13$, $p < .001$, R^2 = .68, and accounted for 68% of the variance in post-manipulation positive affect altogether.

Similarly, for participants who experienced rejection in the Future Life manipulation, higher levels of post-manipulation self-esteem significantly predicted higher levels of positive affect following the experience of rejection, $\beta = .39$, $t = 2.79$, $p = .009$. Adding post-manipulation self-esteem to the model significantly improved the model, $\Delta F(1,27) = 7.80$, $p = .009$, $\Delta R^2 = .11$, and accounted for an additional 11% of the variance in post-manipulation positive affect above and beyond baseline measures. Levels of self-esteem measured at baseline did not significantly predict post-manipulation positive affect when added independently (block 2) but did become significant after controlling for post-manipulation self-esteem (block 3), $\beta = -.31$, $t = -2.19$, $p = .038$, such that higher levels of self-esteem at baseline were associated with lower levels of positive affect post-manipulation, controlling for baseline positive affect and post-manipulation self-esteem. The full regression model was significant, $F(3,27) = 14.38$, $p < .001$, $R^2 = .62$, and accounted for 62% of the variance in post-manipulation positive affect altogether.

For participants who experienced acceptance, post-manipulation self-esteem did not significantly predict post-manipulation positive affect when controlling for baseline levels. However, for those who experienced acceptance in the Future Life manipulation, baseline levels of self-esteem did significantly predict post-manipulation levels of positive affect, $\beta = .23$, $t = 3.00$, $p = .006$, such that higher levels of self-esteem at baseline were associated with higher levels of positive affect post-manipulation, controlling for baseline positive affect. This effect remained significant even after controlling for post-manipulation self-esteem in block 3, $\beta = .21$, $t = 2.35$, $p = .026$.

Adding baseline self-esteem to the model significantly improved the model, $\Delta F(1,28) = 9.01$, $p = .006$, $R^2 = .04$, accounting for an additional 4% of the variance in post-manipulation positive affect above and beyond baseline positive affect and resulting in a significant model overall, $F(2,28) = 95.86$, $p < .001$, $R^2 = .87$.

Among participants who experienced rejection in the Future Life manipulation, higher levels of post-manipulation meaningful existence also significantly predicted higher levels of positive affect following the experience of rejection, $\beta = .33$, $t = 2.69$, $p = .012$. Adding post-manipulation levels of meaningful existence to the model significantly improved the model, $\Delta F(1,27) = 7.23$, $p = .012$, $\Delta R^2 = .10$, and accounted for an additional 10% of the variance in post-manipulation positive affect above and beyond baseline measures. Levels of meaningful existence measured at baseline did not significantly predict post-manipulation positive affect when added independently (block 2), but did become significant after controlling for post-manipulation meaningful existence (block 3), $\beta = -.30$, $t = -2.46$, $p = .021$, such that higher levels of meaningful existence at baseline were associated with lower levels of positive affect post-manipulation, controlling for baseline positive affect and post-manipulation meaningful existence. Altogether, the full regression model was significant, $F(3,27) = 15.28$, $p < .001$, $R^2 = .63$, and accounted for 63% of the variance in post-manipulation positive affect.

For participants who experienced acceptance, post-manipulation levels of meaningful existence did not significantly predict post-manipulation positive affect when controlling for baseline levels. However, for those who experienced acceptance in the

Future Life manipulation, baseline levels of meaningful existence did significantly predict post-manipulation levels of positive affect, β = .19, t = 2.63, p = .014, such that higher levels of meaningful existence at baseline were associated with higher levels of positive affect post-manipulation, controlling for baseline positive affect. This effect remained significant even after controlling for post-manipulation meaningful existence in block 3, β = .23, t = 2.69, p = .012. Although the addition of baseline meaningful existence to the model accounted for only 3% unique variance in post-manipulation positive affect, it did significantly improve the model, $\Delta F(1,28) = 6.91$, p = .014, ΔR^2 = .03, and result in a significant model overall, $F(2,28) = 89.62$, $p < .001$, $R^2 = .87$.

Post-manipulation levels of control did not significantly predict post-manipulation positive affect, controlling for baseline measures, among any of the experimental groups. However, for participants who experienced rejection in the Cyberball manipulation, higher feelings of control at baseline measurement significantly predicted higher levels of positive affect post-rejection, controlling for baseline positive affect, β = .32, t = 2.08, p = .050. This effect did not reach significance once post-manipulation feelings of control were added in block 3, but was approaching significance and in the same direction, β = .30, t = 1.80, p = .086. Adding baseline control to the model in block 2 did result in a significant improvement in the model, $\Delta F(1,22) = 4.32$, p = .050, ΔR^2 = .08, and baseline control accounted for an additional 8% of the variance in post-manipulation positive affect controlling for baseline positive affect. Together, the baseline measures accounted for 61% of the variance in post-manipulation positive affect, $F(2,22) = 17.30$, $p < .001$, $R^2 = .61$.

Post-Manipulation Negative Affect. To understand how cortisol and dimensions of basic needs satisfaction were associated with changes in negative affect during the experiment, hierarchical regressions were conducted using post-manipulation levels of negative affect as the dependent variable. To control for baseline negative affect, the initial measurement of negative affect was added in the first block. For all regressions, the baseline measure of cortisol or needs, respectively, was added in the second block, with the post-manipulation measure of cortisol or needs, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in cortisol or needs, above and beyond baseline levels, predicted post-manipulation negative affect, controlling for baseline levels of all variables.

For participants who experienced acceptance in the Cyberball manipulation, higher cortisol levels post-manipulation were associated with higher levels of negative affect post-manipulation, controlling for baseline measures of cortisol and negative affect, $\beta = .37$, $t = 2.26$, $p = .034$. Adding post-manipulation cortisol levels to the model accounted for an additional 6% of the variance in post-manipulation negative affect, $\Delta F(1,22) = 5.11$, $p = .034$, $\Delta R^2 = .06$. Baseline cortisol was not a significant predictor of post-manipulation negative affect either independently or in combination with post-manipulation cortisol. The full regression model was significant, $F(3,22) = 23.13$, $p < .001$, $R^2 = .76$, and accounted for 76% of the variance in post-manipulation negative affect.

Among participants who experienced rejection, feelings of belonging post-rejection also significantly predicted post-rejection negative affect, controlling for

baseline measures. Lower levels of self-reported belonging following rejection were associated with significantly higher levels of negative affect following rejection, controlling for baseline levels of belonging and negative affect, for those who experienced rejection in the Cyberball manipulation, $\beta = -.47$, $t = -2.36$, $p = .028$. The full regression model was not significant, $F(3,21) = 2.11$, $p = .130$, $R^2 = .23$, but adding post-rejection levels of belonging accounted for an additional 20% of the variance in post-rejection negative affect, controlling for baseline measures, $\Delta F(1,21) = 5.57$, $p = .028$, $\Delta R^2 = .20$. Baseline levels of belonging did not significantly predict post-rejection negative affect either independently or when controlling for post-manipulation belonging.

For participants who experienced rejection in the Future Life manipulation, lower levels of self-reported belonging following rejection were also associated with significantly higher levels of negative affect following rejection, controlling for baseline levels of belonging and negative affect, $\beta = -.42$, $t = -2.87$, $p = .008$. The full regression model was significant, $F(3,21) = 8.06$, $p < .001$, $R^2 = .47$, and adding post-rejection belonging accounted for an additional 16% of the variance in post-rejection negative affect, controlling for baseline measures, $\Delta F(1,27) = 8.22$, $p = .008$, $\Delta R^2 = .16$. Baseline levels of belonging did not significantly predict post-rejection negative affect either independently or when controlling for post-manipulation belonging.

For participants who experienced acceptance, post-manipulation levels of belonging were not significantly associated with post-manipulation levels of negative affect controlling for baseline measures. However, baseline levels of belonging did significantly predict post-manipulation negative affect above and beyond baseline

negative. For those who experienced acceptance in the Cyberball manipulation, higher levels of belonging at baseline were associated with lower levels of negative affect post-manipulation, β = -.26, t = -2.58, p = .016, controlling for baseline negative affect. This effect remained significant after controlling for post-manipulation belonging, β = -.25, t = -2.34, p = .028. Baseline levels of belonging accounted for an additional 6% of variance in post-manipulation negative affect above and beyond baseline negative affect, $\Delta F(1,25) = 6.64$, p = .016, ΔR^2 = .06, and resulted in a significant model overall, $F(2,25) = 40.81$, $p < .001$, R^2 = .77, that accounted for 77% of the variance in post-manipulation negative affect altogether.

For those who experienced acceptance in the Future Life manipulation, higher levels of belonging at baseline were also associated with lower levels of negative affect post-manipulation, β = -.28, t = -2.12, p = .043, controlling for baseline negative affect. This effect was no longer significant after controlling for post-manipulation belonging, but adding baseline levels of belonging did account for an additional 7% of variance in post-manipulation negative affect above and beyond baseline negative affect, $\Delta F(1,28) = 4.50$, p = .043, ΔR^2 = .07. The full model was also significant, $F(2,28) = 16.52$, $p < .001$, R^2 = .54, and accounted for 54% of the variance in negative affect altogether.

Among participants who experienced rejection, post-manipulation levels of self-esteem also significantly predicted post-manipulation negative affect, controlling for baseline measures. For those in the Cyberball manipulation, lower levels of self-esteem following rejection were associated with higher levels of negative affect following rejection, β = -1.11, t = -7.09, $p < .001$, with the addition of post-rejection self-esteem

accounting for an additional 67% of the variance in post-manipulation negative affect, controlling for baseline measures, $\Delta F(1,21) = 50.27$, $p < .001$, $\Delta R^2 = .67$. Baseline levels of self-esteem did not significantly predict post-manipulation negative affect above and beyond baseline negative affect when added in block 2, but after controlling for post-manipulation self-esteem in block 3, higher levels of self-esteem at baseline were significantly associated with higher levels of post-manipulation negative affect, $\beta = 0.88$, $t = 5.67$, $p < .001$. The full model accounted for 72% of the variance in post-manipulation negative affect, $F(3,21) = 17.91$, $p < .001$, $R^2 = .72$.

For those in the Future Life manipulation, lower levels of self-esteem following rejection were also associated with higher levels of negative affect following rejection, $\beta = -0.42$, $t = -2.29$, $p = .030$, with the addition of post-rejection self-esteem accounting for an additional 12% of the variance in post-manipulation negative affect, controlling for baseline measures, $\Delta F(1,27) = 5.24$, $p = .030$, $\Delta R^2 = .12$. Baseline levels of self-esteem did not significantly predict post-manipulation negative affect independently or in combination with post-manipulation self-esteem. The full model accounted for 39% of the variance in post-manipulation negative affect, $F(3,27) = 5.64$, $p = .004$, $R^2 = .39$.

There was no association between post-manipulation negative affect and either baseline or post-manipulation self-esteem for participants who experienced acceptance in the Future Life manipulation, but both baseline and post-manipulation self-esteem significantly predicted post-manipulation negative affect among participants who experienced acceptance in the Cyberball manipulation. When added first (block 2), higher levels of self-esteem at baseline were associated with lower levels of negative affect post-

manipulation, controlling for baseline negative affect, β = -0.48, t = -7.28, p < .001. Baseline self-esteem accounted for an additional 20% of the variance in post-manipulation negative affect, $\Delta F(1,25) = 53.03$, $p < .001$, $\Delta R^2 = .20$. The effect remained significant after adding post-manipulation self-esteem to the model in the third block, β = -0.58, t = -7.55, p < .001. Post-manipulation self-esteem also significantly predicted post-manipulation negative affect, controlling for baseline measures, β = 0.17, t = 2.24, p = .035, such that higher levels of post-manipulation self-esteem were associated with higher levels of post-manipulation negative affect. The addition of post-manipulation self-esteem only accounted for 2% unique variance in post-manipulation negative affect, $\Delta F(1,24) = 5.01$, $p = .035$, $\Delta R^2 = .02$, but the full model, altogether, accounted for 92% of the variance in post-manipulation negative affect, $F(3,24) = 93.72$, $p < .001$, $R^2 = .92$.

For participants who experienced rejection in the Future Life manipulation only, post-manipulation levels of meaningful existence predicted post-manipulation levels of negative affect, controlling for baseline measures. Lower levels of meaningful existence following the rejection experience were associated with higher levels of negative affect following rejection, β = -0.39, t = -2.49, p = .019. Post-manipulation levels of meaningful existence accounted for an additional 13% of the variance in post-manipulation negative affect, $\Delta F(1,27) = 6.22$, $p = .019$, $\Delta R^2 = .13$. Baseline levels of meaningful existence were not significantly associated with post-manipulation negative affect independently or when controlling for post-manipulation meaningful existence, but the full regression model, altogether, was significant and accounted for 42% of the variance in post-manipulation negative affect, $F(3,27) = 6.62$, $p = .002$, $R^2 = .42$.

Additionally, for participants who experienced acceptance in the Cyberball manipulation, baseline levels of meaningful existence significantly predicted post-manipulation negative affect, such that lower levels of meaningful existence at baseline were associated with higher levels of negative affect post-manipulation, controlling for baseline negative affect, $\beta = -0.37$, $t = -5.54$, $p < .001$. Baseline levels of meaningful existence accounted for 13% unique variance in post-manipulation negative affect, $\Delta F(1,25) = 20.59$, $p < .001$, $\Delta R^2 = .13$, and the effect remained significant even after controlling for post-manipulation levels of meaningful existence, $\beta = -0.39$, $t = -4.77$, $p < .001$.

Post-manipulation feelings of control were a significant predictor of post-manipulation negative affect only among those who experienced rejection in the Future Life manipulation. For these participants, lower levels of perceived control following rejection was associated with higher self-reported negative affect post-rejection, controlling for baseline measures, $\beta = -0.37$, $t = -2.44$, $p = .022$. When added to the model, post-manipulation levels of control accounted for 13% of the variance in post-rejection negative affect, above and beyond baseline measures, $\Delta F(1,27) = 5.93$, $p = .022$, $\Delta R^2 = .13$. The full regression model accounted for 41% of the variance in post-rejection negative affect altogether, $F(3,27) = 6.13$, $p = .003$, $R^2 = .41$.

Post-Manipulation Belonging. To understand how cortisol and affect were associated with changes in feelings of belonging during the experiment, hierarchical regressions were conducted using post-manipulation levels of belonging as the dependent variable. To control for baseline levels of belonging, the initial measurement of belonging

was added in the first block. For all regressions, the baseline measure of cortisol or affect, respectively, was added in the second block, with the post-manipulation measure of cortisol or affect, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in cortisol or affect, above and beyond baseline levels, predicted post-manipulation feelings of belonging, controlling for baseline levels of all variables.

Neither baseline nor post-manipulation cortisol levels were significantly associated with post-manipulation feelings of belonging. However, among those who experienced rejection in the Future Life manipulation, higher levels of positive affect post-rejection were associated with higher levels of belonging following the rejection experience as well, controlling for baseline measures, $\beta = 0.61$, $t = 2.68$, $p = .012$. Post-manipulation positive affect accounted for 18% unique variance in post-manipulation belonging, $\Delta F(1,27) = 7.21$, $p = .012$, $\Delta R^2 = .18$. Baseline positive affect was not significantly associated with post-manipulation belonging when added to the model alone (block 2), but after adding post-manipulation positive affect, a significant effect emerged, such that higher levels of positive affect at baseline were associated with lower levels of belonging post-rejection, $\beta = -0.66$, $t = -2.92$, $p = .007$. Together, the full model accounted for 33% of the variance in post-manipulation belonging, $F(3,27) = 4.38$, $p = .012$, $R^2 = .33$.

Post-manipulation levels of negative affect also significantly predicted post-manipulation levels of belonging among those who experienced rejection. For those who experienced rejection in the Cyberball manipulation, higher levels of negative affect following rejection were associated with lower levels of belonging post-rejection, $\beta = -$

0.45, t = -2.36, p = .028. Although the overall regression model was not statistically significant, $F(3,21) = 2.38$, p = .099, R^2 = .25, adding post-manipulation negative affect to the model did result in a significant improvement, $\Delta F(1,21) = 5.57$, p = .028, ΔR^2 = .20, with post-rejection negative affect accounting for 20% of the variance in post-rejection belonging, controlling for baseline measures. Baseline levels of negative affect did not significantly predict post-manipulation levels of belonging alone or in combination with post-manipulation negative affect.

For those who experienced rejection in the Future Life manipulation, higher levels of negative affect following rejection were also associated with lower levels of belonging post-rejection, β = -0.55, t = -2.87, p = .008. The overall regression model accounted for 32% of the variance in post-manipulation feelings of belonging, $F(3,27) = 4.14$, p = .015, R^2 = .32, with the addition of post-manipulation negative affect accounting for 21% unique variance in post-manipulation belonging, $\Delta F(1,27) = 8.22$, p = .008, ΔR^2 = .21. Baseline levels of negative affect did not significantly predict post-manipulation levels of belonging alone or in combination with post-manipulation negative affect.

Post-Manipulation Self-Esteem. To understand how cortisol and affect were associated with changes in self-esteem during the experiment, hierarchical regressions were conducted using post-manipulation levels of self-esteem as the dependent variable. To control for baseline levels of self-esteem, the initial measurement of self-esteem was added in the first block. For all regressions, the baseline measure of cortisol or affect, respectively, was added in the second block, with the post-manipulation measure of cortisol or affect, respectively, added in the third block. The change in R^2 was evaluated

to assess how changes in cortisol or affect, above and beyond baseline levels, predicted post-manipulation self-esteem, controlling for baseline levels of all variables.

Neither baseline nor post-manipulation cortisol levels were significantly associated with post-manipulation levels of self-esteem. However, among participants who experienced rejection, post-manipulation levels of positive affect, but not baseline levels, were significantly associated with post-manipulation self-esteem above and beyond initial levels of self-esteem. For those who experienced rejection in the Cyberball manipulation, higher levels of positive affect following rejection were associated with higher levels of self-esteem post-rejection, $\beta = 0.61$, $t = 3.14$, $p = .005$. The overall regression model accounted for 63% of the variance in post-rejection self-esteem, $F(3,21) = 11.78$, $p < .001$, $R^2 = .63$, with post-rejection positive affect accounting for 18% unique variance in post-rejection self-esteem, controlling for baseline measures, $\Delta F(1,21) = 9.87$, $p = .005$, $\Delta R^2 = .18$. Baseline levels of positive affect did not significantly predict post-manipulation levels of self-esteem independently (block 2), but when post-manipulation positive affect was added in the third black, a significant effect emerged for baseline positive affect as well, such that higher levels of positive affect at baseline were associated with lower levels of self-esteem post-rejection, $\beta = -0.64$, $t = -3.07$, $p = .006$.

For those who experienced rejection in the Future Life manipulation, higher levels of positive affect following rejection were also associated with higher levels of self-esteem post-rejection, $\beta = 0.57$, $t = 2.79$, $p = .009$. The overall regression model accounted for 44% of the variance in post-manipulation self-esteem, $F(3,27) = 7.16$, $p = .001$, $R^2 = .44$, with the addition of post-manipulation positive affect accounting for 16%

unique variance in post-rejection self-esteem, $\Delta F(1,27) = 7.80$, $p = .009$, $\Delta R^2 = .16$. Baseline levels of positive affect did not significantly predict post-manipulation self-esteem alone or in combination with post-manipulation positive affect for this group.

Post-manipulation levels of negative affect also significantly predicted post-manipulation self-esteem. Among participants who experienced acceptance in the Cyberball manipulation, higher levels of negative affect following the manipulation were associated with higher levels of self-esteem post-manipulation, $\beta = 1.04$, $t = 2.24$, $p = .035$. The overall regression model accounted for 51% of the variance in post-rejection self-esteem, $F(3,24) = 8.39$, $p < .001$, $R^2 = .51$, with post-manipulation negative affect accounting for 10% unique variance in post-manipulation self-esteem, controlling for baseline measures, $\Delta F(1,24) = 5.01$, $p = .035$, $\Delta R^2 = .10$. Baseline levels of negative affect did not significantly predict post-manipulation levels of self-esteem independently (block 2), but when post-manipulation negative affect was added in the third black, an effect emerged for baseline negative affect that approached significance, $\beta = -0.71$, $t = -2.02$, $p = .055$, such that lower levels of negative affect at baseline were associated with higher levels of self-esteem post-manipulation.

Among participants who experienced rejection in the Cyberball manipulation, higher levels of negative affect following rejection were associated with lower levels of self-esteem post-rejection, $\beta = -0.64$, $t = -7.09$, $p < .001$. The overall regression model accounted for 84% of the variance in post-rejection self-esteem, $F(3,21) = 36.47$, $p < .001$, $R^2 = .84$, with post-rejection negative affect accounting for 39% unique variance in post-rejection self-esteem, controlling for baseline measures, $\Delta F(1,21) = 50.27$, $p < .001$,

ΔR^2 = .39. Baseline negative affect was not a significant predictor of self-esteem following rejection.

For participants who experienced rejection in the Future Life manipulation, higher levels of negative affect following rejection were also associated with lower levels of self-esteem post-rejection, β = -0.39, t = -2.29, p = .030. The overall regression model accounted for 43% of the variance in post-rejection self-esteem, $F(3,27) = 6.83$, p = .001, R^2 = .43, and the addition of post-manipulation negative affect accounted for 11% unique variance in post-rejection self-esteem, controlling for baseline measures, $\Delta F(1,27) = 5.24$, p = .030, ΔR^2 = .11. Baseline levels of negative affect did not significantly predict post-manipulation levels of self-esteem independently (block 2), but when post-manipulation negative affect was added in the third black, a significant effect emerged for baseline negative affect, β = 0.51, t = 2.72, p = .011, such that higher levels of negative affect at baseline were associated with higher levels of self-esteem post-manipulation.

Post-Manipulation Meaningful Existence. To understand how cortisol and affect were associated with changes in feelings of meaningful existence during the experiment, hierarchical regressions were conducted using post-manipulation levels of meaningful existence as the dependent variable. To control for baseline levels of meaningful existence, the initial measurement was added in the first block. For all regressions, the baseline measure of cortisol or affect, respectively, was added in the second block, with the post-manipulation measure of cortisol or affect, respectively, added in the third block. The change in R^2 was evaluated to assess how changes in

cortisol or affect, above and beyond baseline levels, predicted post-manipulation feelings of meaningful existence, controlling for baseline levels of all variables.

Post-manipulation cortisol levels were not significantly associated with feelings of meaningful existence post-manipulation for any of the experimental groups. However, for participants who experienced acceptance in the Future Life manipulation, lower baseline levels of cortisol were associated with higher levels of meaningful existence following the manipulation, controlling for baseline meaningful existence, $\beta = -0.42$, $t = -2.83$, $p = .009$. This effect remained significant even when controlling for post-manipulation cortisol levels, $\beta = -0.53$, $t = -3.39$, $p = .002$. The addition of baseline cortisol accounted for 15% unique variance in post-manipulation feelings of meaningful existence, $\Delta F(1,28) = 7.99$, $p = .009$, $\Delta R^2 = .15$. Together, baseline meaningful existence and baseline cortisol accounted for 46% of the variance in post-manipulation feelings of meaningful existence, $F(2,28) = 11.89$, $p < .001$, $\Delta R^2 = .46$.

For those who experienced rejection in the Future Life manipulation, higher levels of positive affect following rejection were associated with higher levels of meaningful existence post-rejection, $\beta = 0.64$, $t = 2.69$, $p = .012$. The overall regression model accounted for 28% of the variance in post-rejection meaningful existence, $F(3,27) = 3.51$, $p = .029$, $R^2 = .28$, with post-rejection positive affect accounting for 19% unique variance in post-rejection meaningful existence, controlling for baseline measures, $\Delta F(1,27) = 7.23$, $p = .012$, $\Delta R^2 = .19$. Baseline levels of positive affect did not significantly predict post-manipulation levels of meaningful existence independently (block 2), but when post-manipulation positive affect was added in the third black, a significant effect emerged for

baseline positive affect as well, such that higher levels of positive affect at baseline were associated with lower levels of meaningful existence post-rejection, β = -0.54, t = -2.31, p = .029.

For those who experienced rejection in the Future Life manipulation, higher levels of negative affect following rejection were associated with lower levels of meaningful existence post-rejection, β = -0.48, t = -2.49, p = .019. The overall regression model accounted for 31% of the variance in post-rejection meaningful existence, $F(3,27) = 3.96$, p = .018, R^2 = .31, with post-rejection negative affect accounting for 16% unique variance in post-rejection meaningful existence, controlling for baseline measures, $\Delta F(1,27) = 6.22$, p = .019, ΔR^2 = .16. Baseline levels of negative affect did not significantly predict post-manipulation levels of meaningful existence independently (block 2), but when post-manipulation negative affect was added in the third black, a significant effect emerged for baseline negative affect as well, such that higher levels of negative affect at baseline were associated with higher levels of meaningful existence post-rejection, β = 0.50, t = 2.48, p = .020.

Post-Manipulation Control. To understand how cortisol and affect were associated with changes in feelings of control during the experiment, hierarchical regressions were conducted using post-manipulation levels of control as the dependent variable. To control for baseline levels of control, the initial measurement was added in the first block. For all regressions, the baseline measure of cortisol or affect, respectively, was added in the second block, with the post-manipulation measure of cortisol or affect, respectively, added in the third block. The change in R^2 was evaluated to assess how

changes in cortisol or affect, above and beyond baseline levels, predicted post-manipulation feelings of control, controlling for baseline levels of all variables.

Neither baseline nor post-manipulation levels of control were significantly associated with self-reported feelings of control post-manipulation. Similarly, neither baseline nor post-manipulation levels of positive affect were associated with post-manipulation control either. However, among participants who experienced rejection in the Future Life manipulation, higher levels of negative affect following rejection were associated with lower levels of control post-rejection, $\beta = -0.48$, $t = -2.44$, $p = .022$. Although the overall regression model was not statistically significant, it did approach significance, $F(3,27) = 2.75$, $p = .062$, $R^2 = .23$, and the addition of post-rejection negative affect did significantly improve the model, $\Delta F(1,27) = 5.93$, $p = .022$, $\Delta R^2 = .17$; post rejection negative affect accounted for 17% unique variance in post-rejection control, above and beyond baseline measures. Baseline levels of negative affect did not significantly predict post-manipulation levels of control independently (block 2), but when post-manipulation negative affect was added in the third black, a significant effect emerged for baseline negative affect as well, such that higher levels of negative affect at baseline were associated with higher levels of control post-rejection, $\beta = 0.50$, $t = 2.39$, $p = .024$.

Discussion

Social rejection is, in many ways, a fact of life: it is a common human experience across age, gender, geography, and history. The ubiquity of social rejection also establishes a demand for explanations regarding how humans respond to it. By providing

a comprehensive assessment of responses to different types of social rejection, this research is intended to generate a new understanding of peoples' multiple, interrelated responses to social rejection and how they are affected by situational and dispositional factors. Ultimately, it is hoped that these insights inform theory and future research, but also practice and policy.

Summary of Findings

Hypothesis 1: Main Effects of Social Rejection Versus Acceptance

Effects of Social Rejection. Together, results support that social rejection is associated with aversive physiological, affective, and subjective responses. As expected, when controlling for demographic differences (gender, age, and race/ethnicity), participants who experienced rejection exhibited a significant increase in cortisol post-rejection relative to baseline, consistent with previous research demonstrating an HPA-axis stress response to social rejection (e.g., Beekman et al., 2016; Blackhart et al., 2007; Dickerson & Zoccola, 2013; Gunnar et al., 2003; Jobst et al., 2015; Linnen et al., 2012; Peters et al., 2011; Slavich, O'Donovan et al., 2010; Stroud et al., 2002; Zwolinski et al., 2010). Following the manipulation, but not at baseline, cortisol levels were also significantly higher among those who experienced rejection compared to those who experienced acceptance indicating that the elevated cortisol levels observed among those who experienced rejection is specific to the experience of rejection, not merely a response to participating in effortful activities, and cannot simply be attributed to anxiety about

experimental procedures or being evaluated by researchers. Thus, there is full support for Hypothesis 1a.

Changes in affect observed in this study also complement previous research and theory. Overall, negative affect was higher among participants who experienced rejection compared to those who experienced acceptance, although this difference was significant at baseline as well as post-manipulation. Although neither reached statistical significance, there was a slight decline in negative affect from baseline (M = 1.31) to post-manipulation (M = 1.28) for participants who experienced acceptance, whereas there was a slight increase in negative affect from baseline (M = 1.45) to post-manipulation (M = 1.53) for participants who experienced rejection. Thus, it is possible that there was a small effect of rejection on negative affect that the current study did not have sufficient power to detect. It is also possible that the experimental procedures themselves were not powerful enough to produce a reliable effect on negative affect; some suspicion about the deceptions employed was expressed during debriefing, which may have limited the efficacy of the manipulations.

Participants who experienced rejection exhibited lower levels of positive affect post-manipulation (M = 2.56) compared to participants who experienced acceptance (M = 3.66) although the difference was not statistically significant. However, a significant pre-to-post-manipulation decrease in positive affect was observed for participants who experienced rejection only, in partial support of Hypothesis 1b. Feeling less positive emotions following rejection is consistent with prior research and theory (e.g., Wesselmann et al., 2015; Williams, 2009) suggesting negative emotional impacts of

rejection; a decrease in positive affect may be a milder effect on mood than an increase in negative affect, but is, overall, theoretically consistent.

Consistent with William's (2009) conceptualization of the four dimensions of basic needs (belonging, self-esteem, meaningful existence, and control) that are threatened by ostracism, participants who experienced rejection exhibited pre-to-post manipulation reductions in all four dimensions of basic needs. Those who experienced rejection reported significantly lower levels of belonging, self-esteem, meaningful existence, and control than those who experienced acceptance, and this difference was significant only post-manipulation, thus providing full support for Hypothesis 1c.

Effects of Social Acceptance. As noted, and all in line with hypothesized expectations, at post-manipulation measurement, participants who experienced acceptance reported significantly lower levels of cortisol and negative affect alongside higher levels of belonging, self-esteem, feelings of meaningful existence, and control, relative to participants who experienced rejection. Levels of positive affect were also higher among accepted participants than rejected participants post-manipulation, although not significantly so. Patterns of change from baseline to post-manipulation also indicate a substantially different impact of acceptance on physiological, affective, and subjective needs compared to the experience of rejection. Among accepted participants, cortisol levels and affect remained relatively unchanged, but feelings of belonging increased and an increase in self-esteem was also observed (approaching significance) after the experience of acceptance. Together, findings indicate that unlike social rejection,

experiences of social acceptance are not experienced as stressful or threatening and may have positive effects on core social and personal needs.

Hypothesis 2: Differences Between Manipulation Types

Situational Differences in Responses to Social Rejection. Overall, findings support that not all rejection is experienced the same way and may reflect distinct social pain pathways (Bernstein, 2010; Bernstein & Claypool, 2012a, 2012b; DeWall, 2009; DeWall et al., 2009). Only participants who experienced social rejection in the Cyberball manipulation evidenced a significant pre-to-post-manipulation decline in positive affect, indicating a greater emotional response to being excluded in the Cyberball game, in partial support of Hypothesis 2a. Furthermore, although the effects were not all statistically significant, overall patterns of pre-to-post-manipulation change in affect were consistent with theory and previous research (Bernstein, 2010; Bernstein & Claypool, 2012a, 2012b; DeWall, 2009; DeWall et al., 2009) suggesting increased emotional pain sensitivity for those experiencing the "minor" social injury of rejection in Cyberball and affective flattening for those experiencing the "major" social injury of rejection in the Future Life paradigm: among participants who experienced rejection in Cyberball, there was evidence of a significant decrease in positive affect pre- (M = 2.84) to post-manipulation (M = 2.54) alongside an increase in negative affect pre- (M = 1.32) to post-manipulation (M = 1.49; pre-to-post change nonsignificant), whereas for participants who experienced rejection in Future Life, there was a milder (nonsignificant) decrease in positive affect pre- (M = 2.73) to post-manipulation (M = 2.57) and also a (also nonsignificant) decrease in negative affect pre- (M = 1.58) to post-manipulation (M =

1.46). It is possible that the current study was not sufficiently powered to detect these patterns as statistically significant.

In regard to the effects of rejection on basic needs satisfaction, although a significant pre-to-post-rejection decrease was observed for participants in both manipulations on all four dimensions, in support of Hypothesis 2b, a greater effect size was evidenced among those who experienced rejection in the Cyberball manipulation compared to the those who experienced rejection in the Future Life manipulation. The differences were greater for belonging (Cyberball partial $\eta^2 = 0.60$ versus Future Life partial $\eta^2 = 0.16$), meaningful existence (Cyberball partial $\eta^2 = 0.65$ versus Future Life partial $\eta^2 = 0.23$), and control needs (Cyberball partial $\eta^2 = 0.46$ versus Future Life partial $\eta^2 = 0.04$) than for self-esteem (Cyberball partial $\eta^2 = 0.44$ versus Future Life partial $\eta^2 = 0.37$).

Overall, the pattern of effects is consistent with Bernstein and Claypool's (2012a, 2012b) findings and explanations that differences in severity of the rejection experience may account for differences in responses to different types of rejection experiences. However, it is not clear from either study what situational factors differentiate rejection severity; the Cyberball and Future Life rejection scenarios differ in several ways, including immediacy, chronicity, closeness of those (supposedly) involved, and other factors.

Situational Differences in Responses to Social Acceptance. This study provides evidence that social acceptance may also be experienced differently, depending on the context. Although there were no statistically significant changes in pre-to-post-

manipulation affect among participants who experienced acceptance, there was a slight (nonsignificant) increase in positive affect among participants who experienced acceptance in the Future Life paradigm (baseline $M = 2.74$ to post-manipulation $M = 2.80$) but a slight (nonsignificant) decrease in positive affect among participants who experienced acceptance in the Cyberball paradigm (baseline $M = 2.62$ to post-manipulation $M = 2.52$). Although this does not fully support the hypothesis that acceptance in the Future Life paradigm would be associated with a greater mood-boosting effect than acceptance in the Cyberball paradigm (Hypothesis 2c), it is consistent with expected effects and with more statistical power, these patterns may have been significant. It is also important to note that the specific measure of positive affect may not have been ideal to capture mood-boosting effects of social acceptance; while acceptance may be expected to bolster feelings such as "proud" or "excited" included on the scale, changes in other emotions included on the scale, such as "active" or "alert", are less conceptually relevant. Similarly, many relevant positive emotions, such as happiness or contentment, are not represented on the PANAS positive affect scale.

The pattern of differences in levels of satisfaction with basic needs is clearer: consistent with Hypothesis 2d, only participants who experienced acceptance in the Future Life manipulation evidenced an increase in belonging, self-esteem, and feelings of control following the manipulation relative to baseline. These participants also demonstrated an increase in feelings of meaningful existence, although it was not statistically significant (baseline $M = 4.19$ to post-manipulation $M = 4.33$). In contrast, participants who experienced acceptance in the Cyberball manipulation showed a more

ambivalent pattern of needs satisfaction. The only change from pre-to-post-manipulation that was statistically significant was a *decrease* in feelings of meaningful existence. Although not significant, it is interesting to note that only belonging showed any evidence of increasing post-manipulation (baseline $M = 4.09$ to post-manipulation $M = 4.14$); both self-esteem (baseline $M = 3.58$ to post-manipulation $M = 3.47$) and control (baseline $M = 3.51$ to post-manipulation $M = 3.35$) were lower after the manipulation compared to baseline.

Overall, these patterns are not surprising given the different nature of "acceptance" in the Future Life and Cyberball paradigms. Importantly, in the Future Life paradigm, participants receive direct positive feedback that explicitly references their social relationships, but in the Cyberball paradigm, inclusion in the ball-toss game is a more passive form of acceptance; in fact, because there is no feedback about players level of inclusion (or the potential for exclusion), it is possible that the game-play is not experienced as acceptance or even as a positive experience. Instead, some participants may feel confused by the task or wonder how they are being evaluated or what is being studied in regards to the game-play.

Hypothesis 3: Behavioral Responses

Overall, behavioral responses, as measured by job evaluation ratings, did not provide clear support for differences in prosocial versus antisocial responses to either rejection or acceptance. On average, participants in all experimental groups provided job evaluation ratings that were below the median response option on the 10-point scale, indicating a tendency to respond relatively negatively. This is not wholly surprising: after

all, the experimental procedures were designed (see Twenge et al., 2001) to provide motivation for negative (i.e., antisocial or aggressive) responses. (Recall that prior to providing these job evaluation ratings for the supposed fellow student, that "fellow student" had written an essay on abortion with an opposing viewpoint to the participants' own view *and* provided negative feedback about the participants' essay indicating their personal viewpoint.) However, this also means that there were no clear patterns of "prosocial" responses among experimental groups and, not surprisingly, there were no significant mean differences between experimental groups.

In fact, it was difficult to isolate prosocial behavior patterns in the overall data as well. Only 12% of participants (n = 15) provided job evaluation ratings above the midpoint (5.5) of the response scale; only 3% (n = 4) provided an average rating of seven or higher. Using a minimum definition of prosocial behavior (average rating above the midpoint), these respondents were relatively evenly distributed among experimental conditions. Together, evidence suggests that rejection and acceptance experiences alone did not differentiate behavioral responses in this study.

However, results do indicate that individual differences – both at baseline and in response to experiences of acceptance or rejection – and situational differences are important to understanding behavioral responses. For example, there were significant differences in job evaluation ratings based on dispositional levels of fear of negative social evaluation, suggesting that those who are more fearful of social evaluation were more prone to hostile responses (i.e. providing more negative ratings) when met with the opposing views and negative feedback from the "fellow student". Interestingly, the effect

of fear of negative social evaluation on job evaluation ratings was strongest among those who were accepted in the Cyberball paradigm, suggesting that the relatively ambiguous situation of being included in the ball toss game may have been construed very differently by those high versus low on fear of negative social evaluation.

It is also important to note that affective and subjective responses to social rejection and acceptance were predictive of job evaluation ratings for some experimental groups, meaning that experiencing rejection or acceptance, in and of itself, may be less relevant to future behavior than the *way* in which the rejection or acceptance is felt or perceived. For example, when participants experienced rejection in the Cyberball game, those who experienced higher levels of negative affect in response provided more negative job evaluation ratings, indicating a tendency to lash-out among those feeling badly as a result of the experience. In contrast, those who experienced rejection in the Cyberball manipulation who maintained higher levels of self-esteem following the experience provided more positive job evaluation ratings (or at least "less negative" ratings), while those whose self-esteem decreased following the rejection provided more negative ratings.

For those who experienced acceptance in the Future Life manipulations, more positive (or less negative) ratings were observed for those who had higher levels of belonging following the experience. That is, although acceptance in the Future Life manipulation itself was not associated with a distinct pattern of behavioral responses, how the experience impacted feelings of belonging was indicative of social behavior responses.

Finally, patterns of responses for those who experienced rejection in the Future Life manipulation exhibited a pattern that was consistent with William's (2009) the assertion that social reconnection following rejection is sought in part to restore basic needs. To explain, participants who reported lower levels of belonging, meaningful existence, or control following the rejection experience (controlling for baseline needs), provided more positive (i.e., less negative) job evaluation ratings; rather than lashing out by providing *more* negative ratings, threats to these basic needs may have motivated a tempered response, consistent with the theory that prosocial behavior following rejection is an adaptive response to avoid further rejection or threats to basic needs and perhaps even to restore acceptance or needs.

Isolating "prosocial behavior" (average job evaluation ratings above the midpoint) also indicates that mood and needs satisfaction is relevant to understanding prosocial responses to acceptance and rejection. Prosocial responders had higher positive affect at the beginning of the experiment, whether they were accepted or rejected, and, among those who experienced acceptance, baseline self-esteem was also higher among prosocial responders, suggesting that mood before an experience and/or dispositional differences, influence prosocial responses to experiences. Prosocial responders also reported significantly higher positive affect post-manipulation as well, indicating that affective responses to experiences are relevant to prosocial behavior.

Clearly, behavioral responses to both social rejection and acceptance are nuanced and involve a complex interplay of dispositional, situational, and experiential factors. These findings suggest the need to investigate the psychological mechanisms that account

for different patterns of responses to social experiences. However, the procedures used to evaluate social behavior may not be broadly indicative of prosocial versus antisocial responses to rejection or acceptance experiences. As noted, the current procedures involved a degree of provocation, and also the use of deception, and presented a situation that may not be very familiar to many participants. In fact, the frequency distribution (highly skewed towards negative responses) indicates that the current procedures may not have allowed for evaluation of a full range of behavioral responses.

Hypothesis 4: Interrelated Processes

It is clear that physiological reactivity, affect, and subjective needs are all relevant to understanding psychological and behavioral responses to both rejection and acceptance and show distinct and independent patterns of responses that differ as a function of situational factors. However, results of this study also shed light on how these processes – physiological, affective, and subjective needs – are interrelated. Importantly, that relationships among these responses are observed post-manipulation, even after controlling for baseline measures provides strong evidence that these dimensions of *responses* to rejection and acceptance are interdependent, and not merely a factor of pre-existing individual differences. Also, in some cases, these patterns of interrelations appear to differ based on situational experiences, including whether individuals experienced acceptance or rejection and the nature of each experience (i.e., manipulation paradigm).

For example, for participants who experienced rejection in the Cyberball game only, increased negative affect post-rejection was associated with greater cortisol responses post-rejection. For participants who experienced rejection in the Future Life

paradigm only, greater decreases in either belonging or feelings of meaningful existence post-rejection were associated with post-rejection decreases in positive affect and greater decreases in feelings of control or meaningful existence post-rejection were associated with greater negative affect post-rejection. However, for participants who experienced rejection in either paradigm, decreases in self-esteem post-rejection were associated with greater decreases in positive affect and decreases in either self-esteem or belonging post-rejection were associated with increases in negative affect post-rejection.

Responses to social acceptance were also interrelated, and those patterns of interdependence also showed situational differences. For example, for those who experienced acceptance in the Cyberball manipulation only, increased negative affect following the manipulation were associated with greater cortisol responses post-rejection as well as higher cortisol levels at the end of the study as well. Among those who experienced acceptance in the Cyberball game, those experienced changes in negative affect pre-to-post manipulation also experienced changes in self-esteem: for those who started off low in negative affect, increased negative affect following the manipulation was associated with higher levels of self-esteem post-manipulation, whereas for those we started off higher in negative affect, decreased negative affect following the manipulation was associated with lower levels of post-manipulation self-esteem. These patterns were not significant among those who experienced acceptance in the Future Life paradigm.

Hypothesis 5: Individual Differences.

Although the multilevel SEM indicated that there was only significant between-subjects variability in cortisol responses, there was considerable evidence of individual

differences in responses to social rejection and acceptance on all response dimensions. Therefore, while there is full support for the hypothesized individual-level variability in cortisol (Hypothesis 5a), there is also partial support for individual-level variability in affect (Hypothesis 5b) and needs satisfaction (Hypothesis 5c).

Demographic Differences. There were some demographic differences in responses to rejection and acceptance, although this study was not designed to detect these differences and was largely underpowered for that purpose. Overall, men exhibited a greater increase in belonging following acceptance than did women, and only men demonstrated a significant increase in self-esteem in response to acceptance, suggesting potential gender differences in how acceptance fulfills psychological needs. Evidence of gender differences was mixed for rejection. Specifically, men exhibited a greater cortisol response, whereas women exhibited a greater decrease in feelings of meaningful existence and only women evidence significant decreases in control and positive affect. Together, it is not clear if results support greater responsiveness to rejection among women, as evolutionary (Benenson et al., 2013; Campbell, 1999) and socialization (Bozin & Yoder, 2008; Jackson, 1999) theories have suggested, but there is some indication in the current study that gender differences are relevant to understanding responses to social events – whether negative (i.e., rejection) or positive (i.e., acceptance) – and warrant further exploration in studies that encompass a similar range of physiological, psychological, and behavioral responses.

Some age differences were apparent but appear to be mostly due to lower power to detect pre-to-post manipulation changes among participants over 26 (n = 14).

Differences by race-ethnicity appear to be similar, with a substantially smaller group of non-White participants (n = 38) although non-White participants did evidence a greater increase in belonging when accepted and a greater decrease in positive affect when rejected. Of course, it was not possible to separate out non-White racial/ethnic groups for analysis, which may have masked important racial/ethnic differences in responses to rejection or acceptance.

Small sample sizes by experimental group for men, older participants (over 26), and non-White participants made it difficult to assess differences by condition x manipulation; evidence of difference responses by manipulation paradigm in the overall sample suggest that there may be distinct response patterns to these different experiences and important gender, age, or racial/ethnic differences in these responses may have been missed by grouping the manipulations together for analysis. It is worth noting, however, that the effects of both acceptance and, especially, rejection were so strong that they were able to be detected even in very small groups of participants. For example, even with only 6 degrees of freedom, significant reductions in self-esteem and feelings of meaningful existence post-rejection could be detected among participants 26 and older.

Baseline Affect and Needs. Interestingly, baseline levels of cortisol, affect, and needs also emerged as important sources of individual variability in responses to rejection. For example, those who reported higher levels of self-esteem, meaningful existence or belonging at baseline exhibited greater increases in positive affect and greater reductions in negative affect when they experienced acceptance. Participants who started with lower levels of self-esteem or lower levels of meaningful existence

evidenced greater cortisol levels at the end of the study controlling for previous cortisol measurements, indicating a longer latency to return to baseline for these participants.

Fear of Negative Social Evaluation. As expected, fear of negative social evaluation was a relevant individual difference factor in understanding physiological, affective, and subjective responses to both acceptance and rejection. Overall, however, specific hypotheses received only limited support.

Physiological Responses. Among participants in the Future Life paradigm, there were only significant differences in cortisol responses between participants experiencing rejection versus acceptance among participants high (but not low) in fear of negative social evaluation. This suggests partial support of Hypothesis 5e, even though there was not a significant difference in cortisol response patterns between those high versus low in fear of negative social evaluation among those experiencing rejection overall.

Affective Responses. Levels of fear of negative social evaluation were also associated with different patterns of responses in affect, but only when taking into account situational differences between manipulations as well as conditions (acceptance versus rejection), which provide limited for Hypothesis 5f. For example, there was a significant decrease in positive affect among Cyberball participants only among those high in fear of negative social evaluation. Similarly, while rejection in the Cyberball manipulation was associated with a significant decrease in positive affect for all participants, the effect size was slightly greater among those high in fear of negative social evaluation (partial $\eta^2 = 0.05$ versus partial $\eta^2 = 0.04$). Additionally, for Cyberball participants, negative affect was only significantly lower among accepted versus rejected

participants among those low in negative fear of negative social evaluation; respondents high in fear of negative social evaluation had higher levels of negative affect overall.

Subjective Needs Responses. Similarly, patterns of self-reported needs satisfaction among those high versus low in negative fear of social evaluation indicated limited support for Hypothesis 5g. For example, differences in post-manipulation belonging between accepted and rejected participants were greater among those high versus low in fear of negative social evaluation (partial $\eta^2 = 0.31$ versus partial $\eta^2 = 0.24$), but only among those in the Cyberball manipulation and the decrease in feelings of meaningful existence following rejection in the Cyberball game was also slightly greater among those high versus low in fear of negative social evaluation (partial $\eta^2 = 0.50$ versus partial $\eta^2 = 0.46$). Where effect sizes for pre-to-post-rejection decreases in needs satisfaction were greater among those low in fear of negative social evaluation compared to those high in fear of negative social evaluation (e.g., self-esteem overall, control overall, and belonging in Future Life), the difference is at least partially attributed to lower baseline levels of needs satisfaction among those high in fear of negative social evaluation.

Interestingly, responses to acceptance experiences also appeared to differ based on levels of fear of negative social evaluation. For example, only participants high in fear of negative social evaluation demonstrated a significant increase in belonging or self-esteem post-manipulation relative to baseline when experiencing social acceptance. Likewise, only those high in fear of negative social evaluation exhibited an increase in feelings of control when accepted in the Future Life manipulation. Overall, although differences in

responses based on fear of negative social evaluation were not as straightforward as hypothesized, there is ample evidence that fear of negative social evaluation is a relevant individual-difference factor for understanding physiological, affective, and subjective responses to social experiences.

Behavioral Responses. Individual differences in behavioral responses to social rejection were also evident. There was significant between-subjects variability in job evaluation ratings, supporting Hypothesis 5d. There were no significant differences in ratings by gender, age (under versus over 25), or race (White versus non-White) for either accepted or rejection participants, but higher levels of positive affect at baseline were associated with more positive job evaluation ratings in both conditions. Additionally, consistent with Hypothesis 5d, individual differences in fear of negative social evaluation were associated with differences in job evaluation ratings, such that those higher in fear of negative social evaluation provided more negative job evaluation ratings.

Implications

This study provides valuable insights about how exposure to different types of social threat experiences is associated with different response mechanisms, as well as how different types of people experience similar social threat experiences differently. Together, findings reveal how adaptive social threat protection systems – fundamental to the existence of humans' social nature – manifest in response to social threats in today's modern context.

The purpose of gathering these insights is not merely a matter of scientific curiosity. Social rejection experiences – and differences in responses to them – are critical

for understanding the nature and course of human development as well as how to support health and wellbeing throughout the lifespan. Improving our knowledge about social rejection responses is the first step in developing more effective interventions and therapies for combatting the negative effects of social rejection. The sections below overview key implications for theory, developmental science, and therapeutic applications.

Implications for Theory

Investigating differences in responses to diverse rejection experiences can help to elucidate the dual roles of situational and dispositional factors in catalyzing particular response pathways and may also help researchers better understand humans' underlying social threat detection and response systems. The use of experimental methods, as in the current study, helps to clarify the causal relations and time-course of these processes.

Overall, this research suggests that apparent "paradoxes" in accounts of social rejection response, such as those concerning the nature of emotional and behavioral responses to social rejection, may be attributed to different response pathways that arise from the complex interplay of physiological, affective, and subjective responses that are themselves associated with both situational and dispositional differences. That is, multiple systems have evolved to reinforce and protect humans' social nature, all of which may vary person-to-person and are sensitive to the environmental context. Thus, it is reasonable to expect that social threat experiences (i.e., rejection) will be reliably associated with some sort of evolved threat response (physiological, affective,

psychological, and/or behavioral change), but there may be considerable variability – by person and situation in the exact nature of those responses.

Evidence that social threat responses vary across people and situations and are multi-systemic in nature, may also enable better understanding of potential triggers in the ever-changing social environment and more effective counteraction when those triggers occur. For example, it could easily be argued that the mental health implications of social media use can be understood and addressed through the lens of social rejection and related needs for social connection, belonging, and self-esteem (Ali et al., 2021; Galbava et al., 2021; Hawes, Zimmer-Gembeck, & Campbell, 2020; Hawk, van den Eijnden, van Lissa, & ter Bogt, 2019; Iannone, McCarty, Branch, & Kelly, 2018; Lutz & Schneider, 2021; Rashid, Ahmed, & Hossain, 2019). Likewise, belonging and rejection-avoidance dynamics are critical to understanding (and hopefully countering) some of the most troubling social trends occurring right now, such as the rise of political and ideological extremism (Klien & Simon, 2005; Lyons-Padila et al., 2015; Miller et al., 2021; Obaidi, Skaar, Ozer, & Kunst, 2022), dynamics of social and political polarization (Azzimonti & Fernandes, 2023; Mason, 2018; Moore-Berg, Hameiri, & Bruneau, 2020), and the rampant spread of misinformation (Azzimonti & Fernandes, 2023; Burbach, Halbach, Ziefle, & Calero Valdez, 2019; van Prooijen, 2016). Broad-spectrum effects on individuals' adjustment as a result of these societal trends is already evident and warrants further investigation, using a social threat response framework.

Of course, it is easier to disseminate and apply basic research when it is telling a consistent and digestible story, which is why the current study is also intended to build

theoretical coherency in the study of social rejection by integrating disparate lines of research and characterizing the multiple facets of social rejection responses within an evolutionary framework. An evolutionary-based perspective of responses to social rejection is particularly useful for understanding the developmental implications of social rejection in a way that is less stigmatizing and less susceptible to victim-blaming explanations. Within an evolutionary framework, all responses to rejection are characterized in terms of their adaptive value. Through this lens, prosocial behavior, antisocial behavior, and social withdrawal are all equally adaptive, as are a range of subjective experiences, including strong emotional responses and an apparent lack of emotional response. This viewpoint is inherently more productive as a starting point for efforts to break negative social cycles.

An evolutionary perspective also helps to unify the many nuanced findings of this research. Taken together, the results support the purported evolution of social-threat response mechanisms. As discussed, an evolutionary account of social rejection contends that social rejection is such a critical threat to survival and reproduction that physiological and psychological protection systems were coopted to detect and respond to social rejection and some systems may even have evolved specifically to be sensitive to social rejection threats. Given the serious nature of social rejection as a threat and the known interrelations between physiological, psychological, and behavioral adaptations, an evolutionary account of social rejection responses systems should predict the development (and potentially co-evolution of) multiple response systems spanning physiological, psychological, and behavioral mechanisms. The current study provides

new evidence that social rejection responses do involve responses in multiple systems and that these are interrelated, consistent with the evolutionary account. Furthermore, for these systems to be subject to evolution, inter-individual variability – as demonstrated in this study – is not only expected, but necessary. For the social rejection response to be adaptive, it is also expected – and supported by this study – that the multi-faceted response system should be sensitive to environmental or situational differences.

Thus, taken together, the findings of this study are consistent with the proposition that evolutionary pressures have led humans to be responsive to social threats through multiple physiological and psychological systems that are sensitive to social context. An important implication is that a wide range of physiological, psychological, and behavioral reactions to social rejection should be expected due to difference in rejection situations and individual differences as well as the interactions among variouss systems, and all of which may be understood in the context of adaptive social threat mechanisms.

Developmental Implications

The social nature of human evolution and development (see earlier discussions of *The Origins of Human's Social Nature* & *The Social Nature of Human Development*) would seem to suggest that social rejection is a relevant social threat at any point in the lifespan with substantial impacts on human functioning regardless of age. There is an abundance of evidence to support that assumption. Social rejection is experienced at every phase of life and is linked to a host of developmentally relevant impacts. Additionally, the effects of rejection experiences may build over time, altering subsequent social, emotional, cognitive, and physical functioning, and interacting with changes

neurobiological and psychological development (e.g., Abrams et al., 2011; Hawkley, Williams, & Cacioppo, 2011). A brief review of the role of social rejection during each life stage, below, serves to highlight the relevance of social rejection to understanding human development and functioning.

Early Childhood. Social rejection is evident even in the social groups of very young children (Fanger, Frankel, & Hazem 2012; Godleski et al., 2015; Gunnar et al., 2003) and is associated with physiological stress reactivity in early childhood (Gunnar et al., 2003). In the preschool years, social rejection, especially exclusion, is the predominant form of relational aggression (Fanger et al., 2012). Even at young ages, there is clear evidence that certain children are more likely to be the targets of social rejection than others (Fanger et al., 2012; Godleski et al., 2015; Gunnar et al., 2003), that patterns of chronic rejection can exhibit stability over time (Fanger et al., 2012; Godleski et al., 2015; Gunnar et al., 2003), and that socially skilled and well-accepted children often perpetrate subtle forms of social rejection (e.g., ignoring) against peers who are less socially skilled and/or less accepted in the social group (Fanger et al., 2012; Godleski et al., 2015). Thus, it appears that social rejection is embedded in peer dynamics from an early age and contributes to the development of social functions and social status from the start.

Middle and Late Childhood. As they become more cognitively and socially sophisticated, children – and especially girls – are more likely to engage in all types of relational aggression, including social rejection, and to develop new tactics and expressions of that behavior (Murray-Close, Ostrov, & Crick, 2007;

Spieker et al., 2012). Increased diversity of social rejection behaviors also suggests that recipients' experiences may change considerably during childhood as well. As children learn about their social environment and how to navigate it, experiences of social rejection exert considerable influence on social cognitions and social information processing. At this point, experiencing rejection – especially if repeated – can lead to maladaptive patterns of social information processing biases (e.g., hostile attribution biases) that predispose some children to aggressive responses (Lansford et al., 2010). Thus, experiencing social rejection in childhood can set the stage for negative social dynamics for many years to come. In fact, children who are the victims of chronic social rejection during middle childhood evidence physiological alterations to their processing of social rejection, such as heightened neural responses to rejection, even several years later in adolescence (Will et al., 2016).

Adolescence. There is evidence that the impact of social rejection may be particularly pronounced during adolescence (Abrams et al., 2011; Burnett, Sebastian, Kadosh, & Blakemore, 2011; Pharo, Gross, Richardson, & Hayne, 2011; Sebastian et al., 2011; Sebastian, Viding, Williams, & Blakemore, 2010), when social dynamics are particularly salient and the development of the social brain is at a critical juncture (Blakemore, 2008; Blakemore & Mills, 2014; Fuhrmann, Knoll, & Blakemore, 2015). In addition to heightened neural and affective responses to the pain of rejection (Burnett et al., 2011; Pharo et al., 2011; Sebastian et al., 2011; Sebastian et al., 2010), there is evidence of reduced

activation in regions of the prefrontal cortex associated with emotional regulation among adolescents, specifically, which indicates that adolescents may have more difficulty regulating their responses to social rejection (Sebastian et al., 2011; Sebastian et al., 2010). There is, not surprisingly, also a particularly strong link between social rejection and psychological adjustment in adolescence, including the development of internalizing problems (Sentse, Prinzie, & Salmivalli, 2017) and depressive disorders (Platt, Kadosh, & Lau, 2013), aggressive behavior (Quarmley, Vafiadis, & Jarcho, 2023), and conduct problems (Miller-Johnson et al., 2002).

Increased distress and reduced emotional control may also help to explain why social rejection is especially likely to elicit social susceptibility (e.g., succumbing to "peer pressure") among adolescents (Burnett et al., 2011; Sebastian et al., 2011; Sebastian et al., 2010). Also consistent with accounts of social development during this stage, adolescents are also more likely to report threats to belongingness associated with social rejection than are younger children (who, in turn, report greater decrements to self-esteem rather than belonging), making a clear case for how the self becomes more socially defined in adolescence (Pharo et al., 2011).

Emerging Adulthood. Emerging adulthood is also regarded as a particularly pivotal phase of life for social salience and impact. Like adolescents, emerging adults tend to spend a lot of time with peers and place a high degree of importance on social relationships. Many of the key developmental tasks of

emerging adulthood are socially referent (e.g., identity explorations, instability; feeling “in-between”; Arnett, Zukauskiene, & Suimura, 2014) and considerable social-cognitive development occurs during this period (Lapsley & Woodbury, 2016). Social rejection during this stage is also highly impactful, and perhaps more so than rejection experienced later in adulthood (Pharo, 2012; Pharo et al., 201; Rudert, Janke, & Greifeneder, 2020).

Adulthood. Social rejection is still a common occurrence in adulthood (Pharo et al., 2011; Rudert et al., 2020), particularly in the workplace, where it has negative effects on wellbeing and job performance (Howard, Cogswell, & Smith, 2020; Liu & Xa, 2016; Zheng, Yang, Ngo, Liu, & Jiao, 2016). While there is some evidence that social rejection is experienced less intensely during adulthood than earlier in life by most people (Pharo et al., 2011; Pharo, 2012; Rudert et al., 2020), rejection is still linked with the development of depressive disorders (Kirchner, Schummer, Krug, Kube, & Rief, 2022) and even mass violence committed by adults (Kowalski et al., 2021).

Aging. There is some indication that older adults show a pervasive positivity bias (or at least a reduction in a previously held negativity bias) that is reflected by an overall increase in positive affect and reduction of negative affect in a range of situations and experiences (Cartensen & DeLiema, 2018), including social rejection (Hawkley et al., 2011; Rudert et al., 2020). Interestingly, the reduced sensitivity to social rejection evidence among older adults parallels

reduced sensitivity to physical pain also observed at the same ages (Hawkely et al., 2011), which appears to be consistent with a pain overlap theory explanation.

Despite evidence of some reprieve from social pain, social rejection still occurs among older adults and is still felt to be a negative experience (Goll et al., 2015; Hawkley et al., 2011; Rudert et al., 2020). Social rejection has been implicated as a factor that contributes to social isolation and loneliness among older adults. For example, fear of rejection or exclusion is one of the reasons older adults may withdraw from social participation (Goll et al., 2015). In fact, ageism is often manifested as social rejection in a range of settings; this experience of chronic social rejection due to ones' age has been identified as a factor underlying loneliness in older adults as well (Shiovitz-Ezra, Shemesh, & McDonnell Naughton, 2018).

Researchers also warn that the deleterious effects of social isolation and loneliness among older adults, including increased risk for a range of physical health conditions and early mortality, may, at least in part, reflect cumulative stress responses. That is, the physiological effects of social pain (e.g., chronically elevated cortisol and changes to immune systems) affect the body's functioning over time, leading to the health and mortality outcomes evident later in life (Courtin & Knapp, 2017; Donovan & Blazer, 2020; Holt-Lunstad, 2021; Singer, 2018).

The relevance of social rejection at each life stage implies several contributions of the current research to understanding human development. First, this new evidence of the

interrelationships of physiological, subjective, and behavioral responses to social rejection can help to improve awareness of the widespread effects of social rejection on human functioning. Research that examines these elements in isolation – as much of the previous research has – contributes to a piecemeal body of research that seems to suggest that effects can be physical *or* cognitive *or* emotional *or* behavioral; in contrast, evidence of simultaneous or cascading responses to social rejection paints a very different picture: that social rejection is a broad-spectrum, systematic afront.

The current research, which specifically assesses the comprehensive nature of responses to social rejection, also generates new insight about the potential cumulative impacts of repeated rejection experiences over time. Importantly, individuals experiencing social rejection may be coping with several simultaneous impacts. Coexisting responses (e.g., of feeling a lack of belonging, self-esteem, meaningful existence, and/or control at the same time) can make it difficult to articulate or process feelings associated with rejection experience. This may be especially problematic among children and adolescents who may not yet have developed the emotional intelligence to understand or discuss these multiple simultaneous states. The combined burden of coping with responses across multiple systems may also compound over time if rejection is repeated or chronic. The evidence from this study that changes in cortisol, affect, and needs may be interdependent also may not be a time-limited effect of the immediate rejection experience; that is, changes in one or more systems may affect others over time, leading to the emergence of new effects of the rejection experience over time.

The current study also indicates that these patterns of psychological responses to rejection are relevant to understanding risk for negative adjustment outcomes. Specifically, in this study, neither rejection nor acceptance in and of itself seemed to impact behavior, but emotional responses to those experiences did. Therefore, how individuals respond to and cope with rejection may be a critical intervention point for preventing negative behavioral patterns from developing. Given the repercussions of aggressive behaviors for individuals and societies, research that elucidates processes, mechanisms, or developmental pathways underlying aggressive behavior is a priority for developmental psychologists, as well as parents, educators, and policymakers.

A better understanding of how normative developmental changes in physical systems and cognitive, social, emotional capacities are related to social rejection responses is critical in understanding the lifespan effects of social rejection and developing age-appropriate treatments for social pain. Because of this, researching responses to social rejection during phases of life in which social impacts are known to be particularly consequential is paramount: not only is the impact of social rejection likely to be particularly palpable, but these periods are also prime for intervention, presenting an opportunity to course-correct to prevent the accumulation of continued negative impacts later in life. Thus, the focus on emerging adulthood[21] in the current study is advantageous in many ways (but see *Limitations* for further discussion), given that it is a phase of life characterized by specific developmental challenges (e.g., identity

[21] Note that 92% of the participants in this study are between the ages of 18-30, which corresponds to many definitions of "emerging adulthood" (Arnett et al., 2014); yet, nontraditional college students, even when they are outside this age bracket, are likely to reflect a similar mindset of identity exploration, openness, possibility, and transition associated with their reasons for attending college (Taylor & House, 2010).

explorations, instability, self-focus, broadening of possibilities, and feeling "in-between; Arnett, Zukauskiene, & Suimura, 2014) which may make social connection and belonging even more salient and impactful (Pettit et al., 2011; Spencer & Patrick, 2009; Taylor, Doane, & Eisenberg, 2014). In fact, prior research has considered the unique effects of social rejection during emerging adulthood and has indicated that social tendencies that arise during emerging adulthood tend to have lasting impacts into other stages of adulthood (Jorgensen & Nelson, 2018; Nelson, 2013; Pharo, 2012; Rudert et al., 2020), further highlighting the importance of studying social rejection during this time period in order to identify opportunities for mitigating future consequences.

While it is not clear if the patterns of responses observed in this study are unique to emerging adults[22], the findings decisively show that rejection is experienced as a social threat among emerging adults, with social threat responses triggered in physiological, affective, and subjective psychological systems. Thus, findings support the impact of rejection during emerging adulthood. Yet, at the same time, the finding that social acceptance boosted needs satisfaction suggests that social support and inclusion may also be powerful influencers of adjustment during emerging adulthood.

[22] Distribution of ages in the current study prevented a rigorous analysis of developmental phase differences; there were not enough participants over the age of 30 to analyze separately, and even separating out those 26 and older (according to an earlier definition of emerging adulthood) also created a very small group; overall age differences were negligible and patterns of findings remained the same when excluding older respondents, but without a comparable age group, it is difficult to draw meaningful conclusions.

Implications for Practice

Ultimately, building a more thorough understanding of responses to social rejection is intended to serve as a basis for developing more effective methods for preventing and mitigating the negative effects of social rejection on individuals and society. The literature suggests five specific targets for these efforts based on the risks presented by rejection experiences: (1) alleviating subjective distress, (2) preventing the development of mental health disorders, (3) mitigating physical health impacts, (4) averting aggressive or antisocial behaviors, and (5) avoiding potential for future rejection (i.e., re-victimization). In addition to mental health professionals, parents, educators, policymakers, positive-youth development organizations, and many others can take an active role in applying insights from social rejection research such as this to address one or more of these targets, and their efforts will be more effective if informed by a thorough scientific understanding of the mechanisms and pathways underlying each.

The current study contributes several relevant insights. For example, the interaction of situational and dispositional differences in responses to rejection indicates the need to individualize intervention approaches. Taking the time to listen to and understand what transpired, while acknowledging that individuals may be unique in their responses to situations that seem similar at face value, can allow for channeling support in more effective ways. Knowledge of victims' personalities, their past experiences, and their relationships with those involved may all be relevant in determining whether and how to intervene or offer follow-up support. The current research also implicates individuals' level of fear of negative social evaluation as a relevant factor; recognizing

when individuals who are characteristically hesitant in social situations or highly concerned with the perceptions of others may help target support.

Although not statistically significant in the current study, a pattern of flattened affect did emerge among those rejected in the Future Life manipulation, consistent with the pattern of emotional responses observed in Bernstein & Claypool's (2012a, 2012b) previous research using this same paradigm. In real-world scenarios, the potential for emotional analgesia reinforces that all rejection experiences should be taken seriously, even when the victim does not seem overtly distressed or reports that they "don't care" or "feel fine." There can be a number of reasons why victims of social rejection may underreport their pain, and they may not even be consciously aware of the impact it is having on them physically or behaviorally.

Understanding that aggressive responses to social rejection are among peoples' natural defensive responses can lead to more effective interventions to curb such behaviors. The current research indicates that emotional responses to rejection, in particular, are implicated in the relationship between rejection and aggression. Findings such as these should spur researchers, clinicians, and everyday support systems to look more closely at people displaying aggressive behavior. The cyclical dynamics underlying the aggressive-rejected typology need to be addressed; doing so is likely to be a more effective approach for mitigate aggressive behavior than simply instituting punishments or leveling blame at the aggressor. Here, again, the current research offers a useful clue about the physiological and subjective processes that underlying these types of responses,

suggesting that addressing emotional responses or coping mechanisms may be effective interventions.

Finally, that there are multiple response pathways points to a number of potentially effective avenues for mitigating the effects of social rejection. For example, the power of social acceptance – which also has powerful and pervasive effects – can be leveraged to combat social rejection: building strong friendships (Peters et al., 2011; Zimmer-Gembeck et al., 2013), seeking emotional support (Onoda et al., 2009), and even thinking about positive social experiences (Twenge et al., 2007; Ross & Ignaki, 2023) can be effective in reducing negative responses to rejection. The psychologically boosting effects of social acceptance identified in this study further supports that social acceptance may have important therapeutic benefits, as well as positive effects on adjustment in general.

Strategies focused on improving emotion regulation (DeWall et al., 2011; Riva et al., 2015; Yu, Li, Cao, Mo, Chen, & Zhang, 2023), self-compassion (Miyagawa, 2023), or self-esteem (Onoda et al., 2010) may help to address subjective responses to social rejection in ways that help individuals more effectively cope with the stress or distress of social rejection. Evidence of the negative impact of rejection on affect and psychological needs in this research, as well as the relationship of those response systems to behavioral outcomes, further indicates that interventions addressing the processing, coping, or of emotional and psychological states may be particularly effective in mitigating the effects of rejection on adjustment or the development of negative behavioral patterns.

Additionally, individual differences in response patterns to the same types of situations noted in the current study suggest that people may perceive or construe the social experiences differently. In particular, there was evidence that fear of negative social evaluation or differences in baseline (perhaps dispositional) psychological states may underly different social rejection responses, which, ostensibly could make individuals more susceptible to detecting or responding to evidence of social rejection. As such, the current findings also support that cognitive-behavioral approaches that address biases or deficits in social information processing may also be powerful tools. Reframing rejection experiences (Lau, Moulds, & Richardson, 2009), cognitive bias modification training (Rowlands et al., 2022), minimizing rumination (Wesselmann et al., 2013) and other types of cognitive therapies (e.g., Carbone, 2019; Schnabel & Asendorpf, 2015) have shown promise as well. In fact, the cognitive-behavioral approaches recommended for treating depression and other mental health disorders frequently involve addressing the types of cognitive biases and automatic thoughts that underly aggressive or internalized responses to social rejection, such as negative self-attributions, hostile attribution biases, and social expectancies (Friedman, Thase, & Wright, 2008; Kuyken, Watkins, & Beck, 2005; McGinn, 2000).

Of course, evidence of the effects of social rejection, as demonstrated in this study, should also be impetus for efforts to reduce the incidence of rejection. Although it is true that social rejection itself is an evolutionary adaptation to protect groups and group members (see *Social Motivations in Multilevel Selection*) and thus may always exist to some extent, it is certainly possible to reduce the prevalence of social rejection. Raising

awareness about the harms of social rejection is a first step, especially in settings in which those behaviors are likely to occur, such as schools and workplaces. Not all people are aware of how damaging their behaviors towards others can be, especially when they take the form of more subtle rejection cues like ignoring someone, appearing disinterested, or pointing out someone's differences from the rest of the group.

Intervening is the next step. Although there are some school-based interventions that address relational aggression, most schools focus on anti-bullying curriculums that do not effectively address social rejection (Scheithauer, Hess, Schultze-Krumbholtz, & Bull, 2012; Woods & Wolke, 2003) and the effectiveness of efforts to target relationally aggressive behaviors – which are rarely implemented – varies considerably by program, school, gender, and other factors (Leff, Waasdorp, & Crick, 2010; Leff et al., 2010). Most workplaces do not have programs to address workplace bullying, much less relational aggression or social rejection specifically (Escartin, 2016; Saam, 2010; Stagg et al., 2013).

In addition to expanding programs to educate and reduce social rejection amongst students and employees directly, added support for training teachers, staff, and administrators in schools (Crea, 2009; Van Schojack-Edstrom, 2022) and training managers, leaders, and human resources personnel in organizations (Simmons, 2018; Saam, 2010; Stagg et al., 2013) may also be an important dimension of preventing social rejection and mitigating its consequences – one that is currently underutilized. The current research reinforces key elements of education that are needed, such as the importance of teaching about the diversity of types of social rejection and of reactions

that may exist; the fact that not all responses are visible but may still be impactful; and the importance of breaking rejection-aggression cycles.

Indication of the physiological-subjective-behavioral responses to social rejection in this study also makes a strong case for teaching social-emotional competencies explicitly as part of the education system. Children who learn social-emotional skills exhibit more positive social behaviors, more resiliency, better academic functioning, and higher levels of wellbeing for many years to come (Barrett et al., 2018; Bernard, 2006; Domitovich et al., 2017; Jones et al., 2017; Liew, 2012; Oberle et al., 2014). Teaching social-emotional competencies may help individuals learn more effective ways of handling emotions or social situations without the use of social rejection tactics and may also help them cope with rejection better when they experience it. The relation of aggressive responses to rejection with emotional regulation (Gratz et al., 2013; Mo et al., 2021; Yu et al., 2023) and social informational processing (Claypool & Bernstein, 2019; Dodge et al., 2003; Lansford et al., 2010) suggests that teaching social-emotional competencies from an early age may be a powerful tool in breaking the rejection-aggression cycle, and evidence from this research that psychological states underly differences in responses to rejection is further corroboration.

Limitations

The current study extends knowledge about social rejection in several directions of theoretical and practical importance, yet its primary limitations are in its size, scope, and generalizability. The following sections review these considerations.

What's Overlooked?

This study was designed to detect the relatively large effect sizes identified in previous research analyzing the effects of social rejection. However, this also means that smaller effects may not have been detected in the current study. While many effects of rejection and acceptance, and interrelations of these responses were robust enough to be detected as significant, there were also many effects that were consistent with previous research and hypotheses that failed to reach significance, especially for analyses that required analysis of condition x manipulation. The modest sample sizes, alongside uneven demographic distributions, made it difficult to detect gender, age, or racial/ethnic differences as well.

Important effects of rejection and acceptance may also have emerged due to the limited number of measurements of affect, needs satisfaction, and behavior, especially given evidence that changes in psychological and physiological systems in response to rejection and acceptance may be interrelated. The decision to limit behavioral responses to a single measurement and affect and needs satisfaction to two measurements was made for practical reasons; the current study procedures already required approximately an hour and sometimes up to 90 minutes to administer. Long experimental sessions can undermine data quality due to fatigue and may also pose challenges during recruitment, which was taken into account during research design. However, the point-in-time measurement of behavior and pre-versus-point measurement of affect and needs limit interpretation as well as analysis. Ideally three measurements would have been taken for all response systems.

Finally, evidence of behavioral responses to social rejection may have been biased or truncated. The presence of range restriction in the job evaluation measure among both rejected and accepted participants indicates that the current study did not capture of full spectrum of behavioral responses. It is not clear if this is due to the procedures providing too much motivation for negative responses or whether responses were altered by suspicion of the deception. Alternatively, it could be that the procedures worked well, but the job evaluation measure itself did not sufficiently capture underlying variations in behavioral motivations. Future research should employ other methods to test prosocial and antisocial behavioral responses, including those that do not involve the use of deception.

What's Missing?

The current study provides a more expansive view of rejection responses than has any previous research. Even so, there are of course important elements of social rejection responses that were not assessed in the current study.

Types of Rejection Experiences. The choice of including the Cyberball and Future Life paradigms was intended to complement the previous research (e.g., Bernstein and Claypool, 2012a, 2012b) to provide clear extension of that research. These two paradigms were also deemed to provide clearly differentiated experiences on multiple dimensions (see *Types of Social Rejection Experiences*) which was integral to the objectives of this reseach. However, it must be acknowledged that responses to these paradigms may not generalize to other types of rejection experiences. Previous research seems to show some similarities in responses to being ignored, whether in Cyberball

games, on social media, in a conversation setting, or even as a recalled experience. In particular, patterns of negative affect, reduced basic needs satisfaction, and promotion-oriented responses seem to align (Bernstein and Claypool, 2012a, 2012b; Lutz & Schneider, 2021; Molden et al., 2009). Yet, being ignored may be a unique form of social exclusion for many reasons, including the ambiguity of the experience and its motives (Williams & Zadro, 2001).

Including the Future Life manipulation as the contrast point presents the opportunity to assess responses type of social rejection that is very different in a multitude of ways (see *Types of Social Rejection*). Yet, the forecasting of a future of social rejection, while of interest, is very distinct from other types of rejection experiences in source and substance (Bernstein and Claypool, 2012a, 2012b; DeWall & Baumeister, 2006; Twenge et al., 2001). Thus, there is a range of types of social rejection experiences that are left out of the current study. Furthermore, although there were clear scientific reasons for the choice of these two paradigms, selecting paradigms that vary on a single dimension (e.g., source, duration, setting, etc.) would have allowed for analyses to isolate which specific elements of social rejection experiences differentiate responses.

Threat Detection Mechanisms. The current research advances understanding of responses to rejection but does not directly speak to the mechanisms of social threat detection or how differences in rejection cues and individual difference factors relate to threat detection. In fact, the sociometer model (Leary & Baumeister, 2000), social monitoring system (Pickett & Gardner, 2005), and other descriptions of social threat detection (e.g., Kerr & Levine, 2008; Williams & Zadro, 2013) generally lack systematic

direct investigations of the purported mechanisms of threat detection. In this study, it can be surmised, based on evidence of physiological, subjective, and/or behavioral responses, that individuals detect the experiences as social threats, but, given that these experiences have been demonstrated previously to elicit responses (see *Experimental Manipulations* for a review), this evidence does not substantially add to the body of knowledge, nor does it disentangle what about the experiences, specifically, led individuals to detect a social threat.

Prevention-Focused Responses. The current study provided an opportunity for participants to demonstrate prosocial behavior (i.e., providing a positive evaluation of an individual despite receiving negative feedback from that individual previously), or antisocially (i.e., providing a negative evaluation of an individual who had given them negative feedback previously). However, the parameters of this contrived social opportunity constrained behavior to these two options only and entirely precluded expression of an alternative response: social withdrawal. The tendency to withdraw from social contact following social rejection is quite well-supported in the research (Lutz & Schneider, 2021; Sunami et al., 2019). Theoretically speaking, understanding prevention-focused responses to social rejection should include both aggressive or hostile behaviors (the "fight" response) and withdrawn behaviors (the "flight" response; Kemeny, 2009; Kerr & Levine, 2008; Sasaki & Uchida, 2013). In fact, Sunami, Nadan, and Jaremka (2019) argue that social rejection responses are best understood on a two-dimensional axis: the prosocial-antisocial dimension and the socially engaged-disengaged dimension.

This study, like many other studies, focuses on the prosocial-antisocial continuum and misses the engaged-disengaged dimension entirely (Sunami et al., 2019).

Physiological Activation. Salivary cortisol was chosen as a physiological indicator in the current study because it is a core biomarker for the human response to social stress with well-known health implications (Takahashi et al., 2005). Yet, it is not the only physiological indicator that is relevant to understanding the body's acute and long-term responses to social threats. Other important physiological indicators of social stress include elements of the autonomic stress response like salivary alpha amylase (Ali & Nater, 2020) and components of the immune response (e.g., cytokines; Leschak & Eisenberger, 2019). Additionally, physiological indicators that can be measured in-the-moment, such as heart rate, pupil dilation, or skin conductance (Noushad et al., 2018) have the potential to contribute to the understanding of social threat response systems in real-time, which could not be assessed in the current study via cortisol due to its latency of response.

Individual Differences. Although this research supported the presence of individual differences in all dimensions of social rejection responses, it includes only very limited potential explanations for the source of that variability. Fear of negative social evaluation has been demonstrated to be relevant in understanding social rejection responses and also has a clear physiological basis (Kortink et al., 2018), but it is certainly not the only individual difference factor implicated in responses to social rejection, and there is no indication that it is any more important than other potential explanations.

While fear of negative social evaluation was clearly shown to be relevant, findings indicate that there may be other sources of individual-level variability unaccounted for.

Differences rejection responses as a function of other personality traits, such as rejection sensitivity, self-esteem, narcissism, and belongingness needs have also been identified in previous studies (see *individual differences in responses to rejection* for a review). The evidence that baseline measures of needs satisfaction were relevant to rejection responses suggests that dispositional levels of needs may be an important area of exploration; based on the current procedures, it could not be ascertained that baseline levels were characteristic traits.

There are also many other factors that may differentiate rejection responses, such as factors already known to be related to emotional and physiological sensitivities (e.g., neuroticism or emotional instability) or those known to modulate social responses (e.g., extroversion, self-construal, etc). Considering the well-known interplay between social rejection and mental health (Reinhard et al., 2020), understanding how individuals with current mental health conditions, or who are at risk for certain conditions, process the two different experiences of social rejection could also have improved the clinical relevance of this research.

Additionally, this research could have contributed to practice through analyzing the effect of past experiences on current responses to social rejection. Considering histories of social rejection and other social experiences would allow insight into learned responses to social rejection. Evidence of the relations to attachment, parental rejection, chronic rejection, and having friendships (see *Individual Differences in Responses to*

Rejection for a review) indicate the potential for conditioning of emotional, cognitive, behavioral, and physiological responses. Longer-term longitudinal research (over months or years) is needed to understand the mechanisms by which this occurs; the 60-90 time-course of this study would not have allowed for disentangling these relationships effectively.

Cognitive Responses. The current study involved measurements of multiple dimensions of the social rejection responses but left out a particularly important class of rejection responses: cognitive responses. Previous research has indicated that social rejection impacts a number of cognitive systems, including processes associated with reasoning and logic (Baumeister, Twenge, & Nuss, 2002; Baumeister & DeWall, 2005; Stillman & Baumeister, 2013; Twenge & Baumeister, 2004) and self-regulation (Baumeister et al., 2005; Blackhart et al., 2006; Crescioni & Baumeister, 2009) that may underly behavioral responses. Research has also indicated that the types of attributions individuals make about the nature of the experience, such as the triggering of hostile cognitions (Andrighetto et al., 2019; Ayduk et al., 1999, 2002; Crescioni & Baumeister, 2009; Martinelli et al., 2018; Twenge et al., 2001) or about the potential for future reconnection following rejection (Chen et al., 2012) also impact behavioral responses to social rejection. Furthermore, understanding cognitive responses to social rejection has the potential to improve counseling and therapeutic efforts by providing insight into how cognitive appraisals, cognitive coping mechanisms, and internalized cognitions relate to recovery from social pain experiences. Finally, there is also some indication that social rejection may actually fuel certain cognitive processes, like creativity (Guo, Zhang, &

Pang, 2021; Kim, Vincent, & Goncalo, 2013); this is an underexplored line of inquiry that may point to new therapeutic channels.

Although cognitive responses were not directly evaluated in this study, the findings do suggest that cognitive and social-cognitive factors are a fruitful area of continued exploration. For example, the finding that behavioral responses were associated with differences in emotional responses, but not experimental conditions directly, indicates that there are important mediating mechanisms between social experiences and behavior; the extant literature suggests that cognitive appraisals or attributions may be intervening factors in addition to, or in combination with, affective pathways. Similarly, the relevance of fear of negative social evaluation in responses to social events (both rejection and acceptance) evidenced in this study further suggests social-cognitive mechanisms active in responses to social rejection, which have been previously implicated in the link between individual differences in fear of negative social evaluation and responses to social events (Khanam & Moghal, 2012; Pan-Ru et al., 2019; Tanaka & Ikegami, 2015). Examining cognitive responses may also help to clarify responses to acceptance in the Cyberball paradigm; participants who were included in the Cyberball game did not evidence a social-threat response, but they did not show any mood- or need-boosting effects and did exhibit a significant decrease in meaningful existence. Understanding how participants interpreted the events of the Cyberball game could provide an explanation for these findings and provide insight into responses to relatively ambiguous social events.

Response Pathways. A more mechanistic or process-oriented explanation of social rejection responses would undoubtedly help clinicians pinpoint intervention targets to prevent downstream consequences of social pain and to better understand how social rejection contributes to the etiology of mental health disorders. Evidence of the interrelations between physiological, subjective, and behavioral responses to rejection is an important focus of this study but is only a first step. The current research does not include the moderation and mediation analyses necessary to clarify how the relationships between these elements create pathways to specific behavioral responses or effects on psychological adjustment. For example, some research has indicated that individual differences in physiological stress reactivity (e.g., in cortisol and alpha amylase; Rudolph et al., 2010) and emotional responses (e.g., Debono et al., 2020; Leary, 2022) account for behavioral responses to rejection, but has not explored whether differences in types of rejection experiences may be associated with different response pathways[23].

Previous research has also indicated that understanding social rejection response processes effectively will likely require a more targeted approach to characterizing subjective responses to rejection[24]. For example, the degree to which specific needs (e.g., belonging, self-esteem, control, or meaningful existence) are triggered – either as a function of individual differences (e.g., DeWall, 2011) or as a function of differences in features of the rejection experience (e.g., Warburton et al., 2006) – may impact responses

[23] Note that further analysis of the current data provides an opportunity to contribute to the literature in this regard due to the simultaneous and time-sequenced measurement of physiological, subjective, and behavioral responses.
[24] Note that further analysis of the current data provides an opportunity to isolate effects on and through specific needs and emotions.

to social rejection. Similarly, differences in the specific emotional responses elicited by social rejection may also constitute unique response pathways. Research has indicated that sadness and anger, for example, are tied to different patterns of behavioral responses (e.g., DeWall et al., 2009; Debono et al., 2020).

It is possible that examining specific emotion pathways may help to clarify responses observed in the current study. For example, although there was very limited evidence of effects for negative affect, it is possible that important effects on specific emotions (e.g., distressed or upset) may have been masked by inclusion of non-relevant emotions (e.g., guilty, scared) on the scale. Similarly, the positive affect scale contains a range of emotions that may operate relatively independently (e.g., "excited" versus "determined") or vary in their relevance (e.g., "inspired" or "active").

Ecological Validity

In the current research design, the use of experimental procedures, the temporal cadence of measurement, and the controlled laboratory setting theoretically reduce threats to internal validity (Andrade, 2018; Cahit, 2015)[25], but the trade-off is that there are recognizable threats to external validity (Andrade, 2018). Most notably, the social experiences created for this study were inherently artificial. The laboratory setting, by nature, can change behavior (e.g., the Hawthorne effect; Sedgwick & Greenwood, 2015); although many studies have shown responses to social rejection in laboratory studies that

[25] Note that it is possible that the effectiveness of experimental manipulations (Cyberball and Future Life) and the paradigm for eliciting prosocial versus antisocial behavioral constitutes a risk to the ability to draw conclusions from this research, but the use of paradigms previously used (successfully) by other researchers, the use of pilot testing, and manipulation checks during debriefing minimize that concern.

are generally similar to responses found in naturalistic studies, it cannot be known whether there are any, more subtle, differences.

Additionally, both social rejection and acceptance paradigms, as well as the opportunity for subsequent social interaction used to test behavioral responses (the research assistant job evaluation) all employed the use of deception. Thus, the degree to which individuals believe these deceptions becomes relevant in their responses. There is evidence that participants in laboratory experiments may be aware of the use of deception in research, especially if they already participated in a study involving deception, and that this awareness can invoke heightened suspiciousness among research participants (Jamison, Karlan, & Schechter, 2008; Ortmann & Hertwig, 2002). When it comes to research about social rejection specifically, some research has tested the importance of deception and found that it is relatively *unimportant* to outcomes; across two sets of experiments, Zadro and colleagues (2004) found that negative emotions and threats to basic needs satisfaction were registered even by participants who were told that the Cyberball experience was not real, was completed scripted, or was just a computer program. While this suggests that people are so sensitive to social threats that the believability of the deception is less critical, it cannot be ruled out there are differences in the degree of believability (which were not controlled for, analytically, in this research) or that the degree of believability differentiates the experience from the day-to-day experience of rejection.

The social situations created in the experiment differ from real-world scenarios in other ways too. For example, social interactions in daily life are far more likely to occur

with people that are familiar or close, such as classmates, colleagues, friends, or family members. Research suggests that the source of rejection can impact responses to it (Hawkes, 2011; Jones & Barnett, 2022; Nadzan, 2022). The briefness of the social interactions created for this social experiment may also not be reflective of day-to-day experiences in which social interactions are longer in duration or repeated over time. For instance, children in schools must interact with same-grade peers, especially those in their class(es) for several hours of the day through the course of the school year and, often, for many years in a row. This presents the potential for repeated rejections or triggering of previous social pain. It also means that individuals' social reputations and previous social interactions may influence behavior or responses to rejection[26]. Additionally, ongoing social contact among a peer group leads to the development of peer groups norms that modify the meaning and impact of social behaviors as well, including what behaviors are socially sanctioned within a group (Berger & Caravita, 2016; Dijkstra & Gest, 2014). All of this social context is missing in laboratory studies of social rejection and impacts the ability to draw inferences about the social pain experienced by people in their real lives.

In addition to the contrived nature of social rejection experiences in this research, the opportunity for prosocial versus antisocial behavior may not have passed the test of realism. While individuals may be called upon to give their opinions of people they have only had limited interactions with in their daily lives (hence the basis for this laboratory experience), doing so in the specific context of the research setting (e.g., no physical

[26] Notably, there are differences in the form, function, and impact of peer victimization perpetrated by individuals considered to be popular (Dijkstra, Lindenberg, & Veenstra, 2008).

contact, presumable anonymity) may be very different from the typical social settings in which individuals are asked to make similar judgements. Once again, many factors, like social reputations (Anderson & Shirako, 2008; Emler, 1990), that are typically involved in making judgements about others – perhaps even more so than their actual behavior – were also missing from the equation in this experiment.

Finally, limitations in the sample and sampling strategy may reduce the generalizability of the reported herein findings. While researchers should always be careful about drawing conclusions about "human universals" from research conducted with participants in White, Educated, Industrialized, Rich, Democratic countries – the so-called W.E.I.R.D sample problem (Henrich, Heine, & Norenzayan, 2010) – even within this distinction, a college-student population in a Midwest city is not necessarily reflective of the general U.S. population. Cross-cultural evidence of responses to social rejection throughout the world (e.g., Garris, Ohbuchi, Oikawa, & Harris, 2011), seems to support the universality of responses to social rejection, although contextual differences in types of rejection experiences and the outcome of rejection are a key area of continued exploration.

In some regards, college students are an ideal population for this research: they are embedded in a unique social context that likely increases the salience of social dynamics and they are likely to be confronting the challenges associated with emerging adulthood (see *Developmental Implications* for further discussion of the relevance of rejection during this phase of life). However, college students may be unique, even amongst their emerging adult peers. In many regards, college students epitomize the

definition of emerging adulthood – many of the developmental challenges associated with the life stage are particularly relevant in the college setting (Arnett et al., 2014), but the life experiences, opportunities, and social settings of college students may differ from those of other emerging adults. However, it should be noted that research with other types of populations (e.g., younger children in schools; e.g., Dijkstra et al., 2008; Fanger et al., 2012; adults in workplaces; e.g., Liu & Xia, 2016) seems to show evidence of similar responses as those identified among college students (e.g., Bernstein & Claypool, 2012a, 2012b; Twenge et al., 2001; Twenge et al., 2007).

The fact that emerging adulthood itself is unique means that this research may also not generalize to other stages of life. The idea that social rejection responses are evolved responses to a social threat that is relevant throughout the lifespan, coupled with evidence of similar physiological, emotional, and behavioral responses to social rejection at other periods of the lifespan (see *Developmental Implications* section), seems to indicate that responses to social rejection are perhaps more similar than different across the lifespan. Yet, given that social rejection dynamics – and the resulting impacts – are related to physiological and psychological development (e.g., Abrams et al., 2011; Pharo et al., 2011; Hawkley et al., 2011, Will et al., 2016), there may be differences in the interplay of physiological, subjective, and behavioral responses to rejection that are unique to specific phases of life and are thus obscured with the current sample. As previously noted, the current sample distribution did not allow for a true evaluation of developmental differences in the effects and age comparisons were also very limited.

It should also be considered that no effort was made to control the demographic distribution of the sample for this study and, as such, the study reflects common biases of midwestern college samples. First, the gender distribution of the sample greatly favors women and the literature has indicated that women may respond differently to social rejection (see *Gender Differences in Responses to Social Rejection* section). Gender was included as a covariate in hypothesis testing and descriptive analyses by gender suggested there may be some differences in responses to rejection, but sample sizes, especially for men, limited the ability to draw substantive conclusions.

Second, this sample is predominantly a White non-Hispanic sample and it is not clear if there are racial/ethnic differences in responses to social rejection. Again, race/ethnicity was included as a covariate and element of descriptive analysis[27]; due to small sample sizes and the inability to effectively assess differences by race/ethnicity other than White, the relevance and generalizability of the research across race/ethnicity is not fully evident. No other demographic factors, beyond age, were measured, so the uniqueness of this sample compared to the general population is not fully evident. Differences on other, unmeasured, factors may impact the generalizability of results[28] and could not be controlled for analytically in the current study.

[27] Note that descriptive analyses used a binary distinction for race/ethnicity as White versus non-White; this decision was made due to sample sizes but it is acknowledge that this is not an optimal distinction.
[28] For example, socioeconomic status differences may be relevant to understanding responses to social exclusion; low socioeconomic status has been found to function as a proxy for cumulative stress exposure that may impact social stress responses (Wright & Bukowski, 2021).

Key Contributions

Despite limitations, this study is arguably more comprehensive than any that have come before it in this domain, and it provides several key contributions to the understanding of responses to social threats. In particular, assessing an array of physiological, affective, subjective, and behavioral responses to social experiences revealed that social threats are met with multifaceted responses, and that each of these responses systems operates both independently and interdependently. Furthermore, capturing multiple response dimensions helped to clarify seemingly null effects of rejection on behavior by illuminating the importance of affective responses to social experiences in driving behavioral responses. By measuring physiological, affective, and subjective responses at multiple timepoints, this study also provided a nuanced understanding of how individuals' states prior to encountering a social threat and the changes their experiencing in these systems as a result of the social threat are relevant to understanding how social threats impact adjustment and behavior. Critically, this study allowed for an investigation of both situational (condition x manipulation) and dispositional differences in responses to social threats, both of which were demonstrated to be important sources of variation. Finally, while a substantial body of literature has focused attention on responses to rejection, this study provides the most thorough analysis of responses to social acceptance experiences to date.

Conclusion

It has been approximately 80 years since modern psychology began to take an interest in peer dynamics, including aspects of friendship, acceptance, and rejection (e.g.,

Elkins, 1949; Green, 1933; Tryon, 1944), and express a keen appreciation for the importance of social connection (e.g., Davis, 1940; Zingg, 1940). Yet, despite these many decades of scientific inquiry, there is still so much that is unknown about human social nature. That researchers are still trying to understand how people process and respond to social rejection – perhaps the most fundamental of all social threats – is a testament to the degree to which our social nature is still very much a mystery. Despite the dozens – or hundreds – of studies that have investigated social rejection, our understanding is still incredibly limited.

In providing a comprehensive and systematic evaluation of responses to social rejection, the current research further validates that social rejection truly is a beast with many heads. Social rejection triggers multiple response systems, simultaneously and interdependently. More terrifying yet, these response patterns vary person-to-person and situation-to-situation. Although it may not be clear yet just how many heads this beast really has, the current study provides key evidence in support of a more cohesive theory of social rejection: (1) just as humans have evolved multiple systems to detect and respond to physical threats, they have evolved multiple systems to detect and respond to social threat; (2) just as physiological activation, psychological states, and behavioral responses work in concert to help humans protect themselves from physical threats, social threat response systems also work in synergy; (3) just as people differ in how they perceive and respond to physical threats, they also differ in how they perceive and respond to social threats; and (4) just as responses to different types of physical threats may vary, so too many responses to social threats. As enigmatic as the social rejection

beast may be – and there is still much to be learned about it – it is, in many ways, very familiar. Approaching social threat responses as an analogue to physical threat responses may prove useful to developing a thorough account of how social threats can alter the course of human development. By unveiling the true complexity of responses to social rejection, this research provides a more complete picture of the social nature that is our species' greatest gift – and biggest liability.

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Appendix A
Survey Items

Demographic Questions	
What gender do you affiliate most with?	Male (1) Female (2)
With which racial or ethnic group do you most identify?	White, Non-Hispanic (1) Black, Non-Hispanic (2) Hispanic/Latino/Latina (3) Native Hawaiian/Pacific Islander (9) Asian (10) Other (11)
What year were you born?	[drop-down 2012-1950]
Please indicate your year in college.	Freshman (1) Sophomore (2) Junior (3) Senior (4) Other/Graduate Student (5)
Do you currently use hormonal contraceptives (birth control pills)?	Yes (1) No (2)

Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988)	
STEM: This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment.	
RESPONSE OPTIONS:	Very slightly or not at all (1) A little (2) Moderately (3) Quite a bit (4) Extremely (5)
POSITIVE AFFECT	**NEGATIVE AFFECT**

Interested	Distressed
Excited	Upset
Strong	Guilty
Enthusiastic	Scared
Proud	Hostile
Alert	Irritable
Inspired	Ashamed
Determined	Nervous
Attentive	Jittery
Active	Afraid

Basic Needs Satisfaction (Williams, 2009)

STEM: For each question, please click the number that best represents the feelings you are currently experiencing.

RESPONSE OPTIONS:	1- Not at all (1) 2 (2) 3 (3) 4 (4) 5- Extremely (5)
BELONGING	**SELF ESTEEM**
I feel "disconnected" (R)	I feel good about myself
I feel rejected (R)	My self-esteem is high
I feel like an outsider (R)	I feel liked
I feel like I belong	I feel insecure (R)
I feet that others interact with me a lot	I feel satisfied
MEANINGFUL EXISTENCE	**CONTROL**
I feel invisible (R)	I feel powerful
I feel meaningless (R)	I feel I have control
I feel non-existent (R)	I feel I have the ability to significantly alter events
I feel important	I feel unable to influence the actions of others (R)
I feel useful	I feel that others decide everything (R)

**Note*. Reverse-coded items specified as (R).

Brief Fear of Negative Social Evaluation (Leary, 1983)

STEM: Read each of the following statements carefully and indicate how characteristic it is of you according to the following scale.	
RESPONSE OPTIONS:	1 Not at all characteristic of me (1) 2 Slightly characteristic of me (2) 3 Moderately characteristic of me (3) 4 Very characteristic of me (4) 5- Extremely characteristic of me (5)
I worry about what other people will think of me even when I know it doesn't make any difference.	
I am unconcerned even if I know people are forming an unfavorable impression of me.	
I am frequently afraid of other people noticing my shortcomings.	
I rarely worry about what kind of impression I am making on someone.	
I am afraid others will not approve of me.	
I am afraid that people will find fault in me.	
Other people's opinions do not bother me.	
When I am talking to someone, I worry about what they may be thinking about me.	
I am usually worried about what kind of impression I make.	
If I know someone is judging me, it has little effect on me.	
Sometimes I think I am too concerned with what other people think of me.	
I often worry that I will say or do the wrong things.	

Behavioral Paradigm (Twenge et al., 2001)

SET UP	
Please answer the following question.	Pro-Life (1) Pro-Choice (2)
Please write a brief essay (1-2 paragraphs) about your views on the issue of abortion, indicating your opinion. [open ended]	

PRO-CHOICE ESSAY	PRO-LIFE ESSAY
I think that every woman should have a right to abortion. It's a big decision and should be up to the woman going through the pregnancy, not to outsiders or the men governing laws.. If a woman doesn't think she can provide for the child well enough, she should have the option to have an abortion, because having it anyway could have serious consequences for a child and a mother. Also abortion should always be an option in the case of rape or incest.. Should she really be expected to carry out a pregnancy from that violation? It's really not fair to expect that of anyone. Women should not have to suffer the prolonged consequences of rape, because that wasn't her choice. Women should be free to make their own choice about pregnancy. That choice should not be left up to those who aren't involved in the situation, or the men who create the laws. After all, those men aren't the ones being punished for these unwanted pregnancies.	I believe strongly in pro-life. For the child's sake, abortion should be made illegal. A lot of people believe that a fetus is not a person yet. I completely disagree—abortion is just as bad as murder. It's not okay to murder babies or children at 2 years of age, so how is this any different? You are destroying the life of a human being, someone who could grow up to be a doctor, a professor, or something. We can't allow women to abort their babies because, if we do, that gives all women an easy "out" to a decision they did not think through carefully, logically, or soberly. It is your choice to have sex, and if you do it without protection, you have to be willing to accept the consequences. If women can't afford to have children, then they should think twice before sleeping with someone. Even if a baby is the result of rape or something, it is still a human being. It did not ask to be conceived by violence. The child deserves a chance to live and make something of itself in our world. If anything, it should at least be put up for adoption if the woman doesn't want to keep the child.
ESSAY EVALUATION	
Please indicate below your evaluation of the essay you just read:	1 Strongly Disagree (1) 2 (2) 3 (3) 4 (4) 5 Strongly Agree (5)
This essay was well organized.	
The author clearly stated his or her opinion.	
The author presented good reasons for his or her opinion.	
The author used appropriate spelling and grammar.	
Overall, I think this was a strong essay.	
Comments: [open-ended]	
RESEARCH ASSISTANT JOB EVALUATION	
STEM: Some of the students who are participating in this study are applying for research assist positions for the psychology department at UNO. The psychology department is interested in collecting evaluations of these students. Please use the scale below to evaluate the student you exchanged essays with.	

Please indicate below your evaluation of the essay you just read:	1 Strongly Disagree (1) 2 (2) 3 (3) 4 (4) 5 (5) 6 (6) 7 (7) 8 (8) 9 (9) 10 Strongly Agree (10)
The applicant is friendly.	
The applicant is kind.	
The applicant is open minded.	
The applicant is flexible.	
The applicant would treat research participants with dignity and respect.	
The applicant would be a dependable employee.	
The applicant would be a good representative of UNO.	
I like the applicant.	
I think I would like to participate in a study that was conducted by the applicant.	
If I were in charge of hiring research assistants, I would hire the applicant	

**Note*. Only the "Research Assistant Job Evaluation" questions were used in analysis.

Future Life Feedback (Twenge et al., 2001)

LOW EXTROVERSION	**HIGH EXTROVERSION**

Your extroversion score is: ${e://Field/Score} You received a moderate score on extroversion. Sometimes you may be talkative or outgoing, but you may be quieter and keep to yourself at other times. While on some days you like being surrounded by people and excitement, on other days you prefer to relax on your own. You may like to have a lot of acquaintances, but you would often rather spend your time with a few close friends.	Your extroversion score is: ${e://Field/Score} You received a high score on extroversion. You tend to be outgoing, talkative, and friendly. You like to spend a lot of time surrounded by people and you are often "the life of the party". It is important to you to spend time socializing and you like to have many friends and acquaintances. You like to participate in group activities like sports, clubs, or study groups. You find it easy to get along with most people and enjoy making new friends.
ACCEPTANCE FEEDBACK	**REJECTION FEEDBACK**
Based on all of your scores.... You're the type who has rewarding relationships throughout life. You're likely to have a long stable marriage and have friendships that will last into your later years. The odds are that you'll always have friends and people who care about you.	Based on all of your scores.... You're the type who has rewarding relationships throughout life. You're likely to have a long stable marriage and have friendships that will last into your later years. The odds are that you'll always have friends and people who care about you.

Appendix B
Descriptive Statistics

Table 12. Scale Characteristics for Total Sample

Construct	Min.	Max.	Mean	*SD*	Skewness	Kurtosis
Cortisol Sample 1	0.87	30.16	7.33	5.45	1.48	2.33
Cortisol Sample 2	0.62	38.09	8.80	8.10	1.64	2.67
Cortisol Sample 3	0.26	41.66	8.18	7.74	2.08	5.03
Base, Positive Affect	1.20	4.50	2.72	0.75	0.01	-0.62
Post, Positive Affect	1.20	4.50	2.61	0.82	0.21	-0.88
Base, Negative Affect	1.00	2.80	1.39	0.37	1.38	1.72
Post, Negative Affect	1.00	5.00	1.41	0.57	3.08	14.28
Base, Belonging	2.20	5.00	4.11	0.56	-0.78	0.46
Post, Belonging	1.00	5.00	3.67	1.07	-0.94	0.19
Base, Self-Esteem	1.60	5.00	3.54	0.72	-0.19	-0.17
Post, Self-Esteem	1.00	5.00	3.09	1.02	0.01	-0.99
Base, Meaningful Existence	2.40	5.00	4.28	0.52	-0.89	1.13
Post, Meaningful Existence	1.00	5.00	3.53	1.04	-0.86	-0.13
Base, Control	1.00	5.00	3.45	0.70	-0.62	1.46
Post, Control	1.00	5.00	3.07	0.99	-0.56	-0.64
Fear of Negative Social Evaluation	1.33	4.92	4.01	0.85	0.09	-0.52
Job Evaluation Ratings	1.00	10.00	4.03	1.62	0.94	1.96

Note. Min. = minimum value; Max. = maximum value; Base = baseline measure; Post = post-manipulation measurement

Table 13. Scale Characteristics by Condition

Accepted						
Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**
Cortisol Sample 1	1.15	30.16	6.67	5.33	2.13	6.04
Cortisol Sample 2	0.62	32.19	7.22	6.51	1.90	4.26
Cortisol Sample 3	0.26	25.26	6.81	5.79	1.50	1.84
Base, Positive Affect	1.20	4.50	2.69	0.83	-0.02	-0.74
Post, Positive Affect	1.20	4.50	2.69	0.85	0.04	-0.93
Base, Negative Affect	1.00	2.20	1.32	0.29	1.16	0.88
Post, Negative Affect	1.00	2.44	1.29	0.35	1.32	1.18
Base, Belonging	2.20	5.00	4.05	0.58	-0.86	0.79
Post, Belonging	2.75	5.00	4.34	0.54	-1.07	0.74
Base, Self-Esteem	1.60	5.00	3.55	0.68	-0.76	0.60
Post, Self-Esteem	1.80	5.00	3.69	0.75	-0.48	-0.19
Base, Meaningful Existence	2.40	5.00	4.20	0.54	-1.16	1.82
Post, Meaningful Existence	1.80	5.00	4.08	0.67	-1.33	1.89
Base, Control	1.00	4.80	3.48	0.73	-1.34	2.63
Post, Control	1.60	5.00	3.48	0.71	-0.94	0.62
Fear of Negative Social Evaluation	1.42	4.50	2.94	0.81	0.02	-0.60
Job Evaluation Ratings	1.00	10.00	4.09	1.67	1.27	2.60
Rejected						
Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**
Cortisol Sample 1	0.87	22.16	8.02	5.53	0.95	0.62
Cortisol Sample 2	1.03	38.09	10.44	9.24	1.34	1.46
Cortisol Sample 3	0.98	41.66	9.54	9.14	1.93	3.69
Base, Positive Affect	1.30	4.10	2.76	0.66	0.15	-0.64
Post, Positive Affect	1.40	4.50	2.53	0.78	0.40	-0.71
Base, Negative Affect	1.00	2.80	1.46	0.43	1.17	0.77
Post, Negative Affect	1.00	5.00	1.54	0.71	2.71	9.73
Base, Belonging	2.80	5.00	4.18	0.54	-0.68	-0.04
Post, Belonging	1.00	4.75	2.97	1.05	-0.42	-0.53
Base, Self-Esteem	2.00	5.00	3.54	0.77	0.25	-0.81
Post, Self-Esteem	1.00	5.00	2.45	0.87	1.00	1.09

Base, Meaningful Existence	3.20	5.00	4.35	0.48	-0.46	-0.53
Post, Meaningful Existence	1.00	5.00	2.94	1.05	-0.38	-0.89
Base, Control	2.00	5.00	3.43	0.66	0.40	0.10
Post, Control	1.00	4.60	2.54	0.97	-0.52	-0.99
Fear of Negative Social Evaluation	1.33	4.92	3.08	0.90	0.10	-0.51
Job Evaluation Ratings	1.00	9.40	3.97	1.58	0.53	1.22

Note. Min. = minimum value; Max. = maximum value; Base = baseline measure; Post = post-manipulation measurement

Table 14. Scale Characteristics by Experimental Group

Accepted: Cyberball						
Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**
Cortisol Sample 1	1.42	21.48	7.56	4.97	4.97	0.67
Cortisol Sample 2	0.71	32.19	8.02	6.39	1.99	6.25
Cortisol Sample 3	0.26	22.06	7.68	6.22	1.09	0.39
Base, Positive Affect	1.50	4.00	2.61	0.78	0.04	-1.19
Post, Positive Affect	1.33	4.00	2.52	0.75	0.21	-0.98
Base, Negative Affect	1.00	1.90	1.29	0.25	1.03	0.35
Post, Negative Affect	1.00	2.00	1.22	0.27	1.53	2.21
Base, Belonging	2.60	5.00	4.08	0.57	-0.63	0.06
Post, Belonging	2.75	5.00	4.13	0.64	-0.49	-0.60
Base, Self-Esteem	1.60	4.60	3.62	0.67	-0.99	1.37
Post, Self-Esteem	1.80	5.00	3.45	0.84	0.48	-0.35
Base, Meaningful Existence	2.40	5.00	4.22	0.62	-1.39	2.20
Post, Meaningful Existence	1.80	5.00	3.83	0.81	-0.74	0.10
Base, Control	1.00	4.80	3.49	0.74	-1.29	2.98
Post, Control	1.60	5.00	3.31	0.84	-0.33	-0.51
Fear of Negative Social Evaluation	1.42	4.08	2.92	0.79	-0.13	-0.91
Job Evaluation Ratings	1.00	10.00	4.11	1.92	1.24	2.44
Accepted: Future Life						
Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**

Cortisol Sample 1	1.15	30.16	5.83	5.61	3.20	12.14
Cortisol Sample 2	0.62	28.92	6.47	6.63	2.02	3.93
Cortisol Sample 3	1.03	25.26	6.03	5.35	2.09	5.12
Base, Positive Affect	1.20	4.50	2.77	0.88	-0.12	-0.43
Post, Positive Affect	1.20	4.50	2.84	0.93	-0.22	-0.88
Base, Negative Affect	1.00	2.20	1.34	0.32	1.15	0.78
Post, Negative Affect	1.00	2.44	1.35	0.40	1.04	0.27
Base, Belonging	2.20	4.80	4.02	0.59	-1.11	1.64
Post, Belonging	3.75	5.00	4.55	0.32	-0.80	0.04
Base, Self-Esteem	1.60	5.00	3.48	0.69	-0.59	0.87
Post, Self-Esteem	2.40	5.00	3.92	0.58	-0.89	0.67
Base, Meaningful Existence	3.20	4.80	4.19	0.44	-0.55	-0.55
Post, Meaningful Existence	3.20	4.80	4.33	0.37	-0.91	1.04
Base, Control	1.00	4.40	3.48	0.74	-1.54	2.96
Post, Control	2.80	4.40	3.83	0.42	-0.73	-0.21
Fear of Negative Social Evaluation	1.50	4.50	2.95	0.84	0.13	-0.28
Job Evaluation Ratings	2.30	8.78	4.06	1.43	1.27	2.48

Rejected: Cyberball

Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**
Cortisol Sample 1	2.06	21.13	6.93	4.90	1.44	1.88
Cortisol Sample 2	1.03	36.79	9.53	9.24	1.40	1.59
Cortisol Sample 3	0.98	36.33	8.83	8.95	1.79	2.86
Base, Positive Affect	1.30	4.10	2.79	0.69	0.08	-0.27
Post, Positive Affect	1.40	4.50	2.49	0.81	0.88	0.46
Base, Negative Affect	1.00	2.10	1.29	0.29	1.33	1.49
Post, Negative Affect	1.00	5.00	1.47	0.83	3.61	14.41
Base, Belonging	2.80	5.00	4.24	0.49	-1.07	1.37
Post, Belonging	1.00	4.25	2.36	0.94	-0.09	-0.97
Base, Self-Esteem	2.60	5.00	3.55	0.68	0.24	-0.99
Post, Self-Esteem	1.00	3.80	2.25	0.88	0.14	-1.26
Base, Meaningful Existence	3.40	5.00	4.40	0.43	-0.58	0.09
Post, Meaningful Existence	1.00	3.80	2.25	0.88	0.14	-1.26

Base, Control	2.20	5.00	3.57	0.62	0.29	0.51
Post, Control	1.00	3.40	2.01	0.81	0.34	-1.28
Fear of Negative Social Evaluation	1.33	4.83	2.96	0.93	0.36	-0.59
Job Evaluation Ratings	1.00	9.40	3.65	1.71	1.39	3.73
Rejected: Future Life						
Construct	**Min.**	**Max.**	**Mean**	***SD***	**Skewness**	**Kurtosis**
Cortisol Sample 1	0.87	22.16	8.90	5.91	0.67	-0.72
Cortisol Sample 2	1.12	38.09	11.18	9.31	1.38	1.83
Cortisol Sample 3	1.10	41.66	10.10	9.39	2.11	4.81
Base, Positive Affect	1.70	4.00	2.73	0.65	0.21	-0.96
Post, Positive Affect	1.40	3.70	2.56	0.77	-0.002	-1.52
Base, Negative Affect	1.00	2.80	1.61	0.48	0.80	-0.22
Post, Negative Affect	1.00	3.10	1.59	0.60	1.16	0.31
Base, Belonging	2.80	5.00	4.12	0.58	-0.42	-0.54
Post, Belonging	1.00	4.75	3.50	0.83	-0.84	1.34
Base, Self-Esteem	2.00	5.00	3.53	0.85	0.26	-0.86
Post, Self-Esteem	1.40	5.00	2.57	1.01	1.01	0.38
Base, Meaningful Existence	3.20	5.00	4.31	0.52	-0.33	-0.84
Post, Meaningful Existence	1.20	5.00	3.54	0.79	-1.19	2.24
Base, Control	2.00	5.00	3.30	0.67	0.62	0.35
Post, Control	1.00	4.60	3.01	0.87	-0.55	0.08
Fear of Negative Social Evaluation	1.33	4.92	3.18	0.87	-0.10	-0.06
Job Evaluation Ratings	1.50	6.40	4.28	1.40	-0.51	-0.40

Note. Min. = minimum value; Max. = maximum value; Base = baseline measure; Post = post-manipulation measurement

Table 15. Paired Samples T-Tests, Total Sample

Construct	**Baseline**	**Post-Manipulation**	***t***	**Cohen's d**
	***M* (*SD*)**	***M* (*SD*)**		

Positive Affect	2.72 (0.75)	2.61 (0.82)	2.33*	0.22
Negative Affect	1.39 (0.37)	1.41 (0.56)	0.35	-0.03
Belonging	4.11 (0.56)	3.67 (1.07)	4.03***	0.37
Self-Esteem	3.54 (0.73)	3.09 (1.02)	5.11***	0.47
Meaningful Existence	4.27 (0.51)	3.53 (0.70)	7.11***	0.65
Control	3.45 (0.70)	3.07 (0.99)	3.82***	0.35

*$p < .05$. **$p < .01$. ***$p < .001$.